NOTICE

All drawings located at the end of the document.

FINAL

TRENCHES AND MOUND SITE CHARACTERIZATION WORK PLAN OPERABLE UNIT NO. 2

U.S. DEPARTMENT OF ENERGY
ROCKY FLATS ENVIRONMENTAL
TECHNOLOGY SITE
GOLDEN, COLORADO

ENVIRONMENTAL RESTORATION
PROGRAM

February 1995
Revision 0

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DOCUMENT MODIFICATION REQUEST (DMR)

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8. Item	9. Page	10. Step	11. Proposed Modifications
1	11	1.2.1.2	Reword last paragraph to include "surface material samples" and change level "IV" to to Level "III".
2	28	Fig. 1.2-1	Replace with new figure.
3	35	2.1.1	Reword first paragraph to include "within, in the area surrounding, and potentially beneath".
4	36	2.1.2	Delete the 5th bullet.
5	37	2.1.2	Reword bullets 5 & 6, and insert new bullets 8 & 9.
6	44 45	2.1.3.4	Combine paragraphs 1 & 2, and delete the 3rd and 4th paragraph.

12. Justification (Reason for Modification, EJO #, TP #, etc.)

1 thru 6- Due to a change in intrusive field work methodology, sections of this work plan needs to be modified.

If modification is for a new procedure or a revision, list concurring disciplines in Block 13, and enter N/A in Blocks 14 and 15. If modification is for any type of change or a cancellation, organizations are listed in Block 13, then Concurror prints, and signs in Block 14, and dates in Block 15.

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7	45 to 47	2.1.3.5	Reword and delete parts of the section as required.
8	56	Table 2.3-1	Change the approximate number of samples for subsurface material.

12. Justification (Reason for Modification)

7 and 8- Due to a change in intrusive field work methodology, sections of this work plan needs to be modified.

Approved By:

OU2 Project Manager — Date: 2/27/95

QA Program Manager — Date: 2.27.95

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1,1,1-TCA	1,1,1-trichloroethane
1,2-DCA	1,2-dichlorethane
1,2-DCE	1,2-dichloroethene
4,4'-DDT	4,4'-dichlorodiphenyltrichloroethane
Am-241	Americium-241
ARAR	Applicable or Relevant and Appropriate Requirement
ASTM	American Society for Testing and Materials
bgs	below ground surface
BSL	Background Screening Level
CCl_4	Carbon tetrachloride
CDPHE	Colorado Department of Public Heath and Environment
CHC	chlorinated hydrocarbons
$CHCl_3$	chloroform
CLP	Contract Laboratory Program
CMS/FS	Corrective Measures Study/Feasibility Study
DMR	document modification request
DOE	Department of Energy
DQO	Data Quality Objectives
EE/CA	Environmental Evaluation/Cost Analysis
EM	electromagnetics
EM-31	Geonics EM-31 Terrain Conductivity Meter
EM-61	Geonics EM-61 Terrain Conductivity Meter
EPA	Environmental Protection Agency
ER	Environmental Restoration
ERDA	Energy Research and Development Administration
FID	Flame-ionization detector
FS	feasibility study
GC	gas chromatography
GPR	ground-penetrating radar

GRRASP	General Radiochemistry and Routine Analytical Services Protocol
HRR	Historical Release Report
HSA	Hollow-stem auger
IHSS	Individual Hazardous Substance Site
IM/IRA	Interim Measures/Interim Remedial Action
NAPL	Non-aqueous phase liquid
OU-2	Operable Unit No. 2
OVA	Organic Vapor Analyzer
PA	protected area
PAH	polynuclear aromatic hydrocarbon
PARCC	Precision, accuracy, representativeness, comparability, and completeness
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PID	photoionization detector
PRG	Preliminary Remediation Goal
Pu-239/240	plutonium-239/240
QA/QC	quality assurance/quality control
QA	Quality Assurance
QAA	Quality Assurance Addendum
QAPjP	Quality Assurance Project Plan
QC	Quality Control
RAS	Routine Analytical Services
RFEDS	Rocky Flats Environmental Database System
RFI/RI	RCRA Facility Investigation/Remedial Investigation
SAP	Sampling and Analysis Plan
SOP	Standard Operating Procedure
SVOC	semivolatile organic compound
TCE	trichloroethene
TIC	tentatively identified compound
TPH	total petroleum hydrocarbon

U-233,-234	uranium-233,-234
U-235	uranium-235
U-238	uranium-238
UHSU	upper hydrostratigraphic unit
VOC	volatile organic compound

1.0 INTRODUCTION AND APPROACH

1.1 INTRODUCTION

This document presents the Rocky Flats Operable Unit No. 2 (OU-2) Trenches and Mound Site Characterization Work Plan. The location of Rocky Flats and the boundaries of OU-2 are shown on Figures 1.1-1 and 1.1-2, respectively. The Work Plan describes the steps necessary to collect data for Trenches T-1, T-2, T-4 through T-13 and the Mound Site (Individual Hazardous Substance Site [IHSS] 113) in support of an early removal action program. Trench T-1 is located in the Mound Area; Trench T-2 is in the 903 Pad Area; Trenches T-3, T-4, T-10, T-11, and T-13 are located in the Northeast Trenches Area; and Trenches T-5 through T-9 and T-12 are in the Southeast Trenches Area, as shown on Figure 1.1-3. Trench T-3 (IHSS 110) has been characterized as part of the OU-2 Soil Vapor Extraction Pilot Test Program. Trench T-3 will also be further characterized as part of an early removal action currently in the planning stages. Therefore, characterization of Trench T-3 is not included in this work plan.

To develop the proper approach for characterization of the trenches and the Mound Site, available data for OU-2 were reviewed. These data had been collected during previous investigations, previous soil gas surveys, or are currently being compiled as part of the Preliminary Draft OU-2 Phase II RFI/RI Report (DOE 1993) and the Second Preliminary Draft, Technical Memorandum No. 4, OU-2 Subsurface IM/IRA Soil Vapor Extraction Pilot Test (DOE 1994a). Previous investigations focused on the characterization of groundwater plumes and surface water seeps emanating from OU-2, and contamination of surface and subsurface soils. Boreholes were drilled and monitoring wells were installed in and near the trenches and in the Mound Site. The available data are insufficient to delineate the volatile organic compound (VOC) high concentration areas in the remaining trenches and the Mound Site, as described in Section 1.2, DQO Process. VOC high concentration areas for use in this report will be defined as areas within a trench or the Mound Site with the highest VOC concentration detected with field instruments and screening analysis for that particular trench.

The OU-2 Trenches and Mound Site Characterization Work Plan will use an observational approach that will allow field results to be evaluated as each field activity is completed. With this approach, the investigation of Trenches T-1, T-2, T-4 through T-13 and the Mound Site can be expedited while reducing the potential need for additional phases of field investigation. The Work Plan focuses on gathering data to identify the dimensions and boundaries of the trenches, delineate VOC high concentration areas in the trenches and the Mound Site, and provide other data necessary to complete an engineering evaluation/cost analysis (EE/CA) and implementation plan for an early removal action or remediation of the sources of contamination at these locations.

The program will include geophysical surveys, soil gas surveys, and subsurface material sampling at the trenches, and targeted subsurface material sampling with hollow stem augers at the Mound Site. The Mound Site has been previously characterized as part of the OU-2 RFI/RI and previous soil gas surveys. Therefore, geophysical surveys and soil gas will not be performed at the Mound Site.

Sampling of subsurface material will include sampling of soil, sludge, or liquid that might be encountered in a trench. Subsurface material, for the purpose of this work plan, does not include solid waste or waste material such as metal, plastic, wood, or rebar.

1.2 DQO PROCESS

The Data Quality Objectives (DQO) process, as outlined in Data Quality Objectives for Remedial Response Activities (EPA 1993), was used in developing this work plan. The DQO process ensures that the project objectives are well defined, identifies the environmental data necessary to meet those objectives, and ensures that the data collected are sufficient and of adequate quality for the intended use.

The DQO process is an iterative process designed to focus on decision making and project objectives to ensure that data acquisition activities are logical and cost effective. The DQO process incorporates seven steps: (1) state the problem, (2) identify the decision, (3) identify inputs to the decision, (4) define the boundaries of the study, (5) develop a decision rule, (6) specify acceptable limits on decision error, (7) optimize the design. Although the seven steps are discussed sequentially in this document, they are implemented in an interactive and iterative manner, whereby all DQO elements are continually reviewed and re-evaluated. As such, the DQO process is integrated with development and implementation of the Sampling and Analysis Plan (SAP) and may be revised as needed, based on the results of each data collection activity. DQOs are developed using the seven-step process described in the following sections as tailored to the OU-2 Trenches and Mound Site Characterization Work Plan field investigation program.

1.2.1 Step 1 - State the Problem

Step 1 describes the problem. The available data for OU-2 are insufficient to delineate the VOC high concentration areas in the trenches and Mound Site. Thus the extent of contamination and estimates of the volume of material requiring remediation cannot be completed and a method for remediation cannot be recommended. Therefore, information regarding the site characteristics has been compiled in order to identify data gaps. For the OU-2 Trenches and Mound Site Work Plan, the objective is to gather data to identify the trench horizontal boundaries and VOC high concentration areas present in Trenches T-1, T-2, T-4 through T-13 and the Mound Site (IHSS 113) for subsequent use in an EE/CA. The VOC high concentration areas are targeted for evaluation because previous investigations have shown the presence of VOC contamination in groundwater, and other contamination types (i.e., semi-volatile organic compounds [SVOC], metal and radionuclide contamination) are commonly associated with the VOC high concentration areas. In addition, the VOCs have greater mobility than the other contaminant groups. Therefore, the area of influence for the VOCs is expected to encompass the SVOC, metal, and radionuclide contamination areas. In the EE/CA, data collected as part of the OU-2 Trenches and Mound Site Work Plan field investigation will be interpreted and evaluated to assist in the evaluation and recommendation of remedial alternatives for areas high in VOC concentrations.

1.2.1.1 Results of Previous Investigations

The following sections provide the general location of the trenches and the Mound Site, brief description of the disposal practices at each trench and the Mound Site, data collected from previous investigations to characterize the sites, and a summary of the contaminants that have been detected in or around these sites. Table 1.2-1 presents information about the geological, hydrogeological, and analytical data collected from the previous investigations used to characterize these trenches and the Mound Site. The number of samples collected from each trench and the Mound Site are summarized in this table to illustrate the amount of data collected from previous investigations. This was used to identify data gaps and design the field sampling program described in this document. Geological, hydrogeological, and analytical data presented in the following sections were summarized from information in the Final Phase II RFI/RI Work Plan (Alluvial) Technical Memorandum No.1 (DOE 1991b), the Final Historical Release Report (HRR) for the Rocky Flats Plant (DOE 1992b), and the Preliminary Draft Phase II OU-2 RFI/RI Report (DOE 1993). Figure 1.1-3 shows the location of Trenches T-1 through T-13 and the Mound Site.

1.2.1.1.1 Trench T-1 (IHSS 108). Trench T-1 (IHSS 108) is located north of the Central Avenue, west of the inner east gate, southeast of the Protected Area (PA) fence, and south of the Mound Site (Figure 1.1-3). One hundred twenty-five drums containing depleted uranium chips, hydraulic oil, and carbon tetrachloride (CCl_4) were disposed of in Trench T-1 from 1954 to 1962 (DOE 1991b, DOE 1992b). Some of the drums contained metal turnings still bottoms (residue from a distillation process), cemented cyanide waste, and copper alloy.

Data from Trench T-1 does not show elevated levels of VOCs, SVOCs, pesticides, polychlorinated biphenyls (PCBs), or metals. Slightly elevated activities of americium-241 (Am-241) and plutonium-239/240 (Pu-239/240), which decrease with depth, were detected in Trench T-1 or in the surface or near surface soils around Trench T-1. However, drums containing pyroforic uranium are believed to have been disposed of in Trench T-1. Due to hazards associated with drilling through pyroforic uranium, intrusive methods to be used at Trench T-1 will be evaluated based on the results of the electromagnetic geophysical survey.

1.2.1.1.2 **Trench T-2 (IHSS 109).** Trench T-2 (IHSS 109) is located approximately 100 feet south of the 903 Pad (Figure 1.1-3). The HRR states that the trench was open and nonradioactive solvents were dumped into Trench T-2 in 1969 and 1970. The solvents that may have been dumped include tetrachloroethene (PCE) and trichloroethene (TCE). In addition to solvent dumping, thinner and small quantities of construction-related chemicals were reportedly disposed of in Trench T-2. The dimensions of Trench T-2 are believed to be approximately 20 feet long, 10 feet wide, and 5 feet deep (DOE 1991b, DOE 1992b).

Trench T-2 (IHSS 109) contains PCE, TCE, and other VOCs that may have been transported to the surrounding subsurface soil. Polyaromatic hydrocarbons (PAHs) were detected at depths of 44 feet and greater. PAHs were not detected above the contract required quantitation limit (CRQL) in samples collected at depths less than 44 feet bgs. Arsenic, cadmium, and barium exceeded the background screening levels (BSLs) of the background mean plus two standard deviations in samples collected from within Trench T-2. In general, the activity of Am-241 and Pu-239/240 decreased with depth.

1.2.1.1.3 **Trench T-3 (IHSS 110).** Trench T-3 (IHSS 110) is located north of Central Avenue, east of the inner fence, and south of South Walnut Creek (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium and flattened drums contaminated with uranium were reportedly buried at this trench. This trench was used from 1954 to 1968 (DOE 1991b, DOE 1992b).

The subsurface soil analytical data collected from Trench T-3 indicate that VOC contamination exists in the subsurface soil. VOCs detected include 1,1,1-trichloroethane (1,1,1-TCA), CCl_4, chloroform ($CHCl_3$), PCE, TCE, and 1,2-dichloroethane (1,2-DCA). The concentrations of chlorinated hydrocarbons (CHCs) decrease with depth to the water table. There is contamination by PAHs, Aroclor-1254, and other SVOCs in Trench T-3. Elevated concentrations of arsenic, lead, and silver were also detected in this trench. Elevated activities of Am-241, Pu-239/240, uranium-233,-234 (U-233,-234), uranium-235 (U-235), and uranium-238 (U-238) are also present in Trench T-3.

A stratified non aqueous phase liquid (NAPL) was encountered during drilling. The analytical results for samples of the NAPL indicated the presence of the CHCs, PAHs, gasoline and diesel hydrocarbons, and uranium isotopes.

1.2.1.1.4 **<u>Trench T-4 (IHSS 111.1).</u>** Trench T-4 (IHSS 111.1) is located east of Trench T-3, south of South Walnut Creek, and north of Central Avenue (Figure 1.1-3). The depth of Trench T-4 is estimated to be between 5 and 10 feet. Sanitary sewage sludge contaminated with uranium and plutonium, flattened drums contaminated with uranium, and uranium-contaminated asphalt planking from the solar ponds were reportedly buried in Trench T-4 from 1954 to 1968 (DOE 1991b, DOE 1992b).

Elevated concentrations of PCE and TCE are present in Trench T-4. The concentrations decrease with depth. There are PAHs in the 2-to 8-foot sampling interval which is located within Trench T-4. Aroclor-1254 and 4,4'-dichlorodiphenyltrichloroethane (4,4'-DDT) were detected in one sample from Trench T-4. Metal contaminants include arsenic, cadmium, chromium, copper, mercury, lead, silver, and zinc. Radionuclide contaminants include Am-241, Pu-239/240, U-233,-234, U-235, and U-238. The metal and radionuclide contaminants are believed to be limited to the trench and do not appear to have migrated vertically.

1.2.1.1.5 **<u>Trench T-5 (IHSS 111.2).</u>** Trench T-5 (IHSS 111.2) is located south of Central Avenue, west of the East Spray Field, north of Trench T-6, and northeast of Trench T-9 (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium, and flattened drums contaminated with uranium were reportedly buried from 1954 to 1968 (DOE 1991b, DOE 1992b).

The analytical results show that potential contaminants are limited to VOCs in Trench T-5. Low concentrations of 1,1,1-TCA and 1,2-DCA are present in the subsurface soils at Trench T-5.

1.2.1.1.6 **Trench T-6 (IHSS 111.3).** Trench T-6 (IHSS 111.3) is located south of Trench T-5, west of the East Spray Fields, north of Trench T-7, and east of Trench T-9 (Figure 1.1-3). The trench is estimated to be approximately five to ten feet deep. Sanitary sewage sludge contaminated with uranium and plutonium, and flattened drums contaminated with uranium were reportedly buried from 1954 to 1968 (DOE 1991b, DOE 1992b).

The analytical data collected from Trench T-6 showed that low concentrations of total xylenes and low activities of Pu-239/240 may be present in the subsurface soils.

1.2.1.1.7 **Trench T-7 (IHSS 111.4).** Trench T-7 (IHSS 111.4) is located south of Trench T-6, west of the East Spray Fields, north of Trench T-8, and east of Trench T-9 (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium was reportedly buried between 1954 and 1968 (DOE 1991b, DOE 1992b).

Low levels of 1,2-DCA and total xylenes are present in Trench T-7 soils. Elevated levels of Am-241 and Pu-239/240 were observed in Trench T-7.

1.2.1.1.8 **Trench T-8 (IHSS 111.5).** Trench T-8 (IHSS 111.5) is located south of Trench T-7, west of the East Spray Field, north of Woman Creek, and east of Trench T-9 (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium, and flattened drums contaminated with uranium were reportedly buried from 1954 to 1967 (DOE 1991b, DOE 1992b).

Low concentrations of 1,2-DCA are present in Trench T-8. Elevated concentrations of lead in the near-surface soils may be indicative of contamination in Trench T-8. Pu-239/240 contamination may be present at low activities within Trench T-8.

1.2.1.1.9 **Trench T-9 (IHSS 111.6).** Trench T-9 (IHSS 111.6) is located southwest of Central Avenue, west of Trench T-7, and north of Woman Creek (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium, and flattened drums contaminated with uranium, scrap metal, and junk were reportedly buried from 1954 to 1968 (DOE 1991b, DOE 1992b).

The analytical data for Trench T-9 indicate that 1,2-DCA and total xylenes were detected in the subsurface soils. PAHs and Aroclor-1254 were detected in the upper eight feet. Infrequent detections of metals exhibiting low concentrations only slightly above the BSLs were observed in samples from Trench T-9. Low activities of Pu-239/240 contamination appear to be present in Trench T-9.

1.2.1.1.10 **Trench T-10 (IHSS 111.7).** Trench T-10 (IHSS 111.7) is located north of Central Avenue, east of Trench T-11, and south of Trench T-4 (Figure 1.1-3). Trench T-10 was reportedly used for the burial of sanitary sewage sludge contaminated with uranium and plutonium. In addition to the sludge, flattened drums contaminated with uranium were reportedly disposed of in Trench T-10 between 1954 and 1968 (DOE 1991b, DOE 1992b).

1.2.1.1.11 **Trench T-11 (IHSS 111.8).** Trench T-11 (IHSS 111.8) is located north of Central Avenue, west of Trench T-10, and south of Trench T-3 (Figure 1.1-3). Sanitary sewage sludge contaminated with uranium and plutonium, flattened drums contaminated with uranium and plutonium, and plutonium- and uranium-contaminated asphalt planking from the solar ponds were reportedly buried in Trench T-11 from 1954 to 1968 (DOE 1991b, DOE 1992b).

The analytical data collected from Trench T-11 indicate that 1,1,1-TCA was detected in the subsurface soil. Samples with elevated VOC results were collected below high groundwater level, therefore the presence of other VOC contaminants may be associated with the contaminated upper hydrostratigraphic unit (UHSU) groundwater in this area. Low-level Pu-239/240 contamination may also exist in Trench T-11.

1.2.1.1.12 **Trench T-12.** Trench T-12 is located east of the inner east guard station and south of Trench T-13 (Figure 1.1-3). It is now partially covered with asphalt or base material of the east access road. The HRR (DOE 1992b) states that this trench is estimated to be about ten feet deep and primarily contains sewage sludge. This sewage sludge is believed to contain uranium and plutonium contamination. Flattened drums may also be present in this trench. Elevated activities of Am-241 and Pu-239/240 exist in the surface soils or near surface soils around Trench T-12.

1.2.1.1.13 **Trench T-13.** Trench T-13 is located approximately 500 feet east northeast of the inner east guard station and south of IHSS 111.8 (Figure 1.1-3). Aerial photographs indicate that it was open between 1966 and 1967. It is now entirely covered by asphalt or base material as part of the northern extension of the east access road, which was built in 1968. The total length of the trench is approximately 250 feet. The aerial photos indicate that it was filled with dark grey material, which may be sewage sludge. No source boreholes were drilled into Trench T-13, since this trench was not identified until the preparation of the HRR (DOE 1992b) and after the OU-2 field work had been completed. However, previous process knowledge suggests that Trench T-13 contained the same types of waste as the other nearby trenches.

1.2.1.1.14 **Mound Site (IHSS 113).** The Mound Site (IHSS 113) is located north of Trench T-1 (IHSS 108), east of the PA fence, south of South Walnut Creek, and west of the inner east gate (Figure 1.1-3). The Mound Site was reportedly used as a disposal site between 1954 and 1958 for drums containing depleted uranium- and beryllium-contaminated hydraulic oil and CCl_4. Records indicate burial of drums in this site, some of which were also contaminated with enriched uranium and plutonium, and PCE (DOE 1991b, DOE 1992b). Drums were removed from the site in 1970.

Analytical data collected to date from the Mound Site indicate the presence of PCE and TCE, with increasing concentrations to a depth of approximately 20 to 30 feet, and then decreasing concentrations below that depth. The PAH, fluoranthene, is present in near-surface samples. The PCB, Aroclor-1254, was detected in two near-surface soil samples. Elevated activities for Am-241 and Pu-239/240 in the near surface samples indicate surface or near surface waste-related radionuclide contamination in the Mound Site.

1.2.1.2 Conceptual Site Model

An integral part of the DQO process is the development of a Conceptual Site Model (CSM) which identifies and describes pathways by which receptor populations may be potentially exposed to chemicals of concern. The conceptual site model for OU-2 at Rocky Flats was previously developed and is presented in Technical Memorandum No. 5, Human Health Risk Assessment Exposure Scenarios (DOE 1994b).

The primary source of chemicals in OU-2 is contaminated surface and subsurface soil at the 903 Pad, Mound, and East Trenches areas. Potential release mechanisms from contaminated soil to the environment include storm water runoff, volatilization, wind suspension, infiltration and percolation to groundwater, direct contact, root uptake, and radioactive decay. Transport media include groundwater, surface water, soil gas, and air. These release and transport mechanisms and affected media are illustrated in the CSM presented in Figure 1.2-1. Primary subsurface soil contaminants and UHSU groundwater contaminants for each IHSS area are shown on Figures 1.2-2 through 1.2-5.

The CSM is a schematic representation of the chemical source areas, chemical release mechanisms, environmental transport media, potential human intake routes, and potential human receptors. The purpose of the CSM is to provide a framework for problem definition to identify exposure pathways that may result in human health risks, to aid in identifying data gaps, and to aid in identifying effective remediation alternatives, if necessary, that are targeted at significant contaminant sources and exposure pathways.

Release mechanisms for this evaluation would include infiltration and percolation (transport to groundwater), volatilization, and direct contact. The potential human receptors for these pathways would be a future, on-site gravel miner, and an on-site construction worker.

Potentially complete pathways for the future on-site gravel miner are:

- Inhalation of airborne particulates (from subsurface soil)
- Ingestion of subsurface soil
- Dermal contact with subsurface soil
- External radiation from decay of radionuclides in subsurface soil

Complete exposure pathways to be evaluated for the construction worker scenario are:

- Inhalation of airborne particulates from subsurface soil
- Subsurface soil ingestion
- Dermal contact with subsurface soil
- External irradiation from decay of radionuclides in subsurface soil.

The risk exposure pathways identified in the CSM have been used to develop programmatic risk-basked preliminary remediation goals (PRGs) which are contaminant and medium specific levels of exposure that are protective of human health. For subsurface soils, gravel miner and construction worker scenarios were considered and risk based PRGs were calculated based on the exposure pathways described earlier for the construction worker and gravel miner scenarios. These risk based PRGs will be used in the assessment of remediation alternatives in the EE/CA. Contaminant concentrations for subsurface material samples collected from the trenches and Mound Site will be compared to the PRGs to allow identification of VOC high concentration areas and calculation of a volume of material to be remediated. The data collected for the EE/CA are not designed to support risk assessment directly, but to allow remediation to meet PRGs. However, subsurface material sample data will be collected at Level III and, therefore, will be suitable for subsequent use in risk assessment, if desired.

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1.2.1.3 Applicable or Relevant and Appropriate Requirements

Applicable or Relevant and Appropriate Requirements (ARARs) regarding potential technologies for remediation of the sources of contamination in Trenches T-1, T-2, T-4 through T-13 and the Mound Site will be identified and presented in the EE/CA. Chemical ARARs will be identified and will include the sitewide PRGs for the on-site gravel miner and the construction worker subsurface soil scenarios. Location-specific and action-specific ARARs will also be developed based on the alternatives assembled in the EE/CA.

1.2.2 Step 2 - Identify the Decision

Data collected as part of the OU-2 Trenches and Mound Site Work Plan field investigation and the previously collected RFI/RI data will be interpreted and evaluated as part of the EE/CA. These data could also be used in the corrective measures study/feasibility study (CMS/FS). The EE/CA and CMS/FS will be prepared separately from this document. Data will be compared to sitewide PRGs to allow identification of the source areas and calculation of a volume of material to be remediated so that remediation alternatives can be developed and evaluated. Evaluation of removal and/or remediation actions for the trenches and Mound Site, and a comparative analysis of alternatives will be performed in the EE/CA. These alternatives, including no action, will be evaluated with respect to effectiveness, implementability, and cost. The decisions to be made in the EE/CA will be no further action or a recommended alternative(s).

1.2.3 Step 3 - Identify Inputs to the Decision

Data collected during the OU-2 Trenches and Mound Site Work Plan field investigation will be input into the EE/CA process to provide support for developing remediation objectives, risk evaluation, development and evaluation of alternatives, and the decisions regarding remediation of the trenches and Mound Site. The data collected will consist of:

- Approximate horizontal dimensions of the trenches, as determined by review of aerial photographs and geophysical surveys

- Locations and areal extent of soil gas VOC high concentration areas in the trenches

- Chemical concentration data for VOCs, SVOCs, metals, and radionuclides in subsurface materials collected in the center of each identified VOC high concentration area

- Chemical concentration data for NAPLs present in the trenches, if encountered and recoverable

- Chemical concentration data from subsurface material samples collected from two previously identified VOC high concentration areas in the Mound Site

- Geotechnical properties of subsurface materials in the trenches and Mound Site

Additional data regarding the nature and extent of contamination in and near the trenches and Mound Site will be taken from the Draft OU-2 Phase II RFI/RI Report (DOE 1993) and previous soil gas surveys. Other considerations that may affect the decisions will be identified in the EE/CA, such as an evaluation of risk from the chemicals of concern identified in the trenches and Mound Site, political and social factors, and time and budget constraints.

1.2.4 Step 4 - Define the Boundaries of the Study

Step 4 specifies the spatial and temporal boundaries that affect the collection of data and the smallest area for which a separate decision will be made. Step 4 should also define the current and future use of the site and the potential exposure pathways and receptors by which contamination from the site may affect human health or the environment. The OU-2 Trenches and Mound Site Characterization Work Plan specifies the procedures necessary to gather data to support the EE/CA and implementation of an early removal action/remediation alternative. The locations of Trenches T-1 through T-13 are shown on Figure 1.1-3. Trench T-3 (IHSS 110) has been characterized as part of the OU-2 Soil Vapor Extraction Pilot Test Program and therefore is not included in this program.

Trenches T-1, T-2, and T-4 through T-13 and the Mound Site will be investigated under this work plan. Each site will be investigated independently. This work plan will identify the steps necessary to collect the data needed to evaluate and implement an early removal action/remediation of the sources of VOC high concentrations in these areas. A cost-effective observational approach for collecting data in the trenches area will be specified in order to determine the trench dimensions and boundaries, delineate VOC high concentration areas, and characterize subsurface materials collected from within each VOC high concentration area.

Current land use and future land use of the trenches and Mound Site areas, and potential exposure pathways and populations are described in detail in Technical Memorandum No. 5, the Draft Final Human Health Risk Assessment Exposure Scenarios (DOE 1994).

Current Rocky Flats operations and maintenance activities are limited in OU-2. The 903 Pad portion of OU-2 is capped. Most of OU-2 is located in the buffer zone, beyond the security fence and developed portion of the facility. Current activities in these areas consist of environmental investigations, monitoring, cleanup, and routine landscape maintenance and security surveillance.

Rocky Flats is currently performing environmental restoration activities and planning for decontamination and decommissioning, waste management, transition, and economic development.

Future land use would most likely involve industrial or office complexes at the developed portions of the plant, and mining and open-space uses in the buffer zone. Thus, an on-site construction worker and an on-site gravel miner were identified as exposure pathway receptors for a qualitative risk evaluation in the EE/CA. The conceptual site model (Section 1.2.1.2) illustrates the release and transport mechanisms and affected media. Transport of contamination to groundwater is of primary concern in the evaluation of remediation alternatives for the source areas.

1.2.5 Step 5 - Develop a Decision Rule

Step 5 defines the process by which the data collected will be compared to the decision criteria. The data collection program for the trenches and Mound Site will use an observational approach that will allow field results to be evaluated as each field activity is completed. For this type of field program a decision rule diagram, Figure 1.2-6, has been developed to define the pathway on which the field program must proceed to collect appropriate data for future use in the EE/CA and implementation plan.

Data collected during the OU-2 Trenches and Mound Site Work Plan field investigation will be compared against the decision criteria developed in the EE/CA. The decision criteria will be developed using the following site specific ARARs: chemical specific, such as PRGs; action specific; and location specific, and will be presented in the EE/CA.

In general, all the available data (chemical and physical) will be summarized in the EE/CA. Identification and an estimate of the size of source areas will be made based on field soil gas screening results, field observations, and sample analytical results. A qualitative risk evaluation and comparison of analytical data to PRGs will be performed to support development of removal action/remediation alternatives. Remediation alternatives will be identified and evaluated with respect to effectiveness, implementability, and cost. A comparative analysis of alternatives will be performed and an alternative will be recommended. A decision rule diagram, Figure 1.2.7, has been developed to identify the decision process for the EE/CA.

1.2.6 Step 6 - Specify Acceptable Limits on Decision Error

During this step of the DQO process, constraints on the level of uncertainty that the decision maker is willing to accept in the determination of the outcome of the decision are identified. These constraints typically include the establishment of acceptable decision error limits and consequences of false positive or negative results on the decision to be made. Decision error is comprised of both sampling error and measurement error.

Procedures have been incorporated in this work plan to reduce field and laboratory measurement error and uncertainty. As an example, two methods of field analysis for soil gas will be performed to reduce uncertainty: field instrument screening and on-site mobile laboratory analysis of soil gas. Initially, soil gas samples will be screened in the field using field instruments. Approximately 30 percent of the screened locations will be sampled concurrently and sent to an on-site mobile laboratory for confirmation analysis. The purpose of the on-site analysis is to reduce the uncertainty inherent with a field instrument. Additional soil gas samples will be collected for analyses from locations of the trench where the highest initial soil gas concentrations are found. At these locations, soil samples will also be collected to provide confirmation of screening results and reduce further uncertainty. If the soil sample results conflict with the soil gas screening results, additional soil samples may be collected to further reduce uncertainty.

Section 3.0 of this work plan provides a discussion of the quality assurance/quality control procedures which will be implemented to minimize measurement error to the extent practical, particularly for soil and soil gas analyses performed by the laboratory. Minimum measurement error will be accomplished in part by analyzing field and laboratory QA/QC samples in conjunction with analyses of field soil and soil gas samples.

Additionally, this work plan provides a field sampling and analytical program rationale, including geophysical and soil gas surveys, which is intended to identify VOC high concentration areas within the trenches and Mound Site for subsequent soil sample collection and analysis. Therefore, the potential for significant impacts on decision making due to sampling error have been addressed to the extent practical.

Given the primary objective of this work plan which is identification of VOC high concentration areas for evaluation in the EE/CA, quantitative limits on decision error were not established. This approach is appropriate since the probability of making a wrong decision (i.e., a VOC high concentration area is actively present although it was not identified during this project) is not high. Ongoing CMS/FS and risk assessment studies for the trenches and Mound Site will address data and decision uncertainty for the project area investigated under the work plan.

As part of the EE/CA, the RFI/RI and trenches data will be evaluated and interpreted to identify areas for potential early action and remediation. A rough delineation of a contaminated area will be made. The data collected from the trenches program will provide sufficient information along with assumptions regarding extent of contamination in the horizontal and vertical direction to make a rough estimate of the volume of material to be remediated. Remediation alternatives being evaluated such as excavation or in situ treatment (vitrification or soil vapor extraction) are not precise methods and do not require exact delineation of the remediation area. As a conservative approach, remediation will likely extend outside the boundary of the area identified for remediation during this study.

1.2.7 Step 7 - Optimize the Design

Step 7 describes the procedures that will be implemented to obtain data of acceptable quality and quantity to make the required decisions. Through the process of addressing the elements identified in Steps 1-6, all the components required for completion of Step 7 should be available. The OU-2 Trenches and Mound Site field investigation program will use an observational approach that will allow field results to be evaluated as each activity is completed. Figure 1.2-6 presents the decision path for the observational approach for the data collection activities. With this approach, the investigation of Trenches T-1, T-2, T-4 through T-13 and the Mound Site can be expedited while reducing the potential need for additional phases of field investigation. Section 1.2.7.1 describes the data types that will be obtained during this program. The level of analytical data quality required for each data type (summarized in Section 1.2.7.3.) is based on the end use of the data (described in Section 1.2.7.2). Section 1.2.7.4 briefly summarizes the quantity of data expected to be obtained from the OU-2 Trenches and Mound Site field investigation. Section 1.2.7.5 defines the indicators (Precision, Accuracy, Representativeness, Completeness, and Comparability [PARCC] Parameters) used to assess overall data quality.

The SAP (Section 2.0) describes the sampling objectives and the proposed methods of data/sample collection. Section 2.0 also identifies the locations to be sampled, the types of data that will be collected, and the analytical methods selected for chemical characterization. The selected analytical methods, sampling containers, preservation requirements, analytical holding times, and the approximate number and type of samples to be collected are summarized in Table 2.3-1. The Quality Assurance Project Plan (Section 3.0) identifies the sampling SOPs to be used, provides cross reference to chemical analysis and data validation procedural documents, specifies the number and types of field QC samples to be collected, and defines how the PARCC parameters will be interpreted and assessed for the OU-2 Trenches and Mound Site field investigation

1.2.7.1 Data Types

Specific data types to be collected during implementation of the OU-2 Trenches and Mound Site Characterization field investigation include:

- Stratigraphic data (e.g., depth, thickness, texture, etc.) on the occurrence, nature, and distribution of geologic units within the OU-2 trenches and the Mound Site (from lithologic logs prepared during drilling).

- Geotechnical data on physical properties (grain size distribution, moisture content, dry density, porosity, vertical permeability) of geologic units (from analysis of geotechnical samples).

- Screening level data using a photoionization detector (PID) and/or flame-ionization detector (FID) on the concentration of VOCs in soil gas samples collected from two different depths within each trench.

- Screening level data (PID and/or FID) on the concentration of VOCs and the radiological activity in subsurface material samples collected from VOC high concentration areas within each trench and the Mound Site.

- Chemical data (VOCs) for confirmation samples collected to verify the results of the soil gas survey.

- Chemical data (VOCs, SVOCs, metals, and radionuclides) for subsurface materials collected in VOC high concentration areas.

- Chemical data for NAPLs collected from the boreholes within the trenches and Mound Site, if present.

1.2.7.2 Data Use

Chemical data derived from the OU-2 Trenches and Mound Site Characterization field investigation will be used for a number of purposes, including:

- Screening of soil gas samples using a PID and/or FID and a field radiological detector to identify areas of VOC high concentrations, aid in selecting subsurface material samples for laboratory analysis, and health and safety monitoring.

- Laboratory analysis of soil gas confirmation samples to verify the results of the soil gas screening survey. Results from the laboratory are expected within 24 hours of receipt.

- Laboratory analysis of subsurface material samples from VOC high concentration areas to evaluate the nature of contamination in those areas.

- Laboratory analysis of geotechnical samples to evaluate the physical properties of subsurface materials in the source areas.

- Laboratory analysis to characterize the nature of NAPLs present at a particular location.

1.2.7.3 <u>Data Quality</u>

The analytical options available to support data collection activities are presented in five general levels (EPA 1993). The level of data that is obtained for each data type is dependent on the intended use of the data. These levels (listed below) are distinguished by the types of technology and documentation used.

- Level V - Laboratory analysis using nonstandard methods. Radiological analyses and analyses that may require method modification and/or development. The laboratory may or may not be a Contract Laboratory Program (CLP) laboratory. This level is appropriate for use in the EE/CA.

- Level IV - CLP Routine Analytical Services (RAS). This level is characterized by rigorous QA/QC protocol and documentation. All analyses are performed in an off-site CLP analytical laboratory following CLP protocol. This level is not necessary and/or cost effective for use in the EE/CA.

- Level III - Laboratory analysis using methods other than CLP RAS. This level is used primarily to support engineering studies and risk assessments using standard EPA-approved procedures. Some procedures may be equivalent to CLP RAS without CLP requirements for documentation. The laboratory may or may not be a CLP laboratory. This level is appropriate for use in the EE/CA.

- Level II - This level is characterized by the use of portable analytical instruments which can be used on site, or in mobile laboratories stationed near a site. This level is appropriate for determining the presence of contaminants, relative concentrations, and screening of samples. Appropriate for real-time data (i.e., turnaround time within hours of receipt). This level is appropriate for use in the EE/CA.

- Level I - This level is characterized by the use of portable instruments which can provide real-time data to assist in the optimization of sampling point locations. This level is appropriate for screening.

The level of analytical data deemed appropriate for the OU-2 Trenches and Mound Site Characterization field investigation is as follows:

- Laboratory analyses for radionuclides are considered non-standard analyses; therefore, the analytical level for these constituents in all media will be in accordance with Level V analytical requirements (EPA 1993).

- Laboratory analysis of VOCs, SVOCs, and metals in subsurface samples from VOC high concentration areas will be performed in accordance with Level III analytical procedures and reporting requirements. Sufficient documentation will be obtained to allow for full data validation. Laboratory analysis of TPH (Total Petroleum Hydrocarbons), will also be in accordance with Level III analytical requirements.

- Laboratory analysis of NAPLs, if performed, will be in accordance with Level III analytical procedures and reporting requirements. Sufficient documentation will be obtained to allow for full data validation.

- Laboratory analysis of soil gas confirmation samples will be conducted using gas chromatography (GC) methods in accordance with Level II analytical requirements.

- Initial screening of subsurface material samples using a PID and/or FID and field radiological detector and the analysis of soil gas samples using a PID and/or FID will be performed in accordance with Level I analytical requirements.

- Analytical results will be compared with field screening results as a check for field instrument accuracy.

1.2.7.4 Data Quantity

Soil gas samples will be collected from two depths at approximately 20 sampling stations in each trench. Additional soil gas sample locations needed to delineate VOC high concentration areas will be determined by the results of the initial screening. Approximately 30 percent of the soil gas samples will be selected at random and submitted for on-site mobile laboratory analysis as confirmation of the soil gas results. Approximately eight subsurface material samples will be collected in the Mound Site and submitted for laboratory analysis. The number of subsurface samples collected in the trenches will be determined based on the results of the soil gas survey. NAPLs will be sampled if encountered in the trenches. Samples will be analyzed for TPH if staining is encountered. The number and type of samples to be collected during implementation of the OU-2 Trenches and Mound Site Characterization field investigation program is further discussed in the SAP (Section 2.0).

1.2.7.5 PARCC Parameters

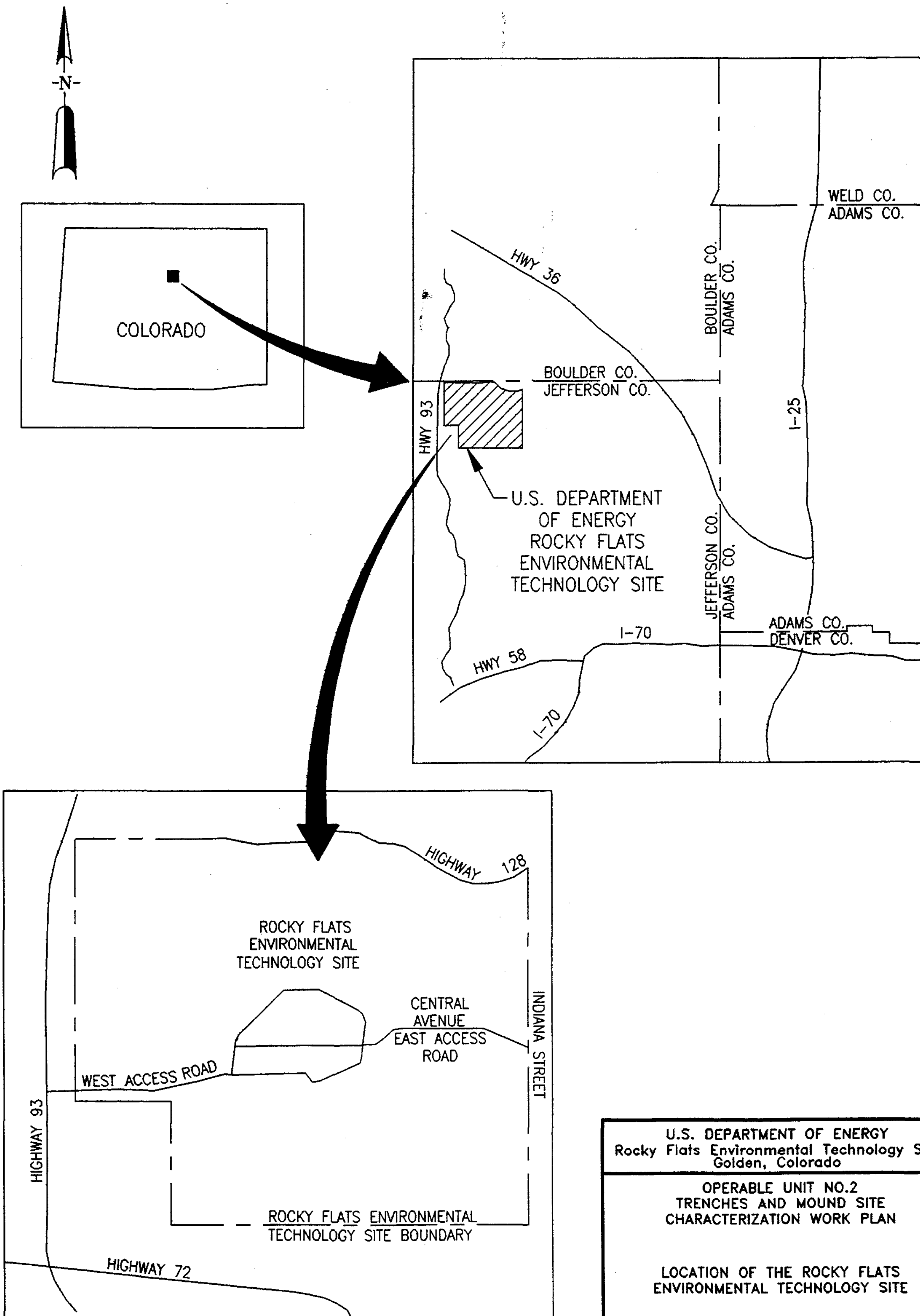
The PARCC parameters (i.e., precision, accuracy, representativeness, completeness, and comparability) are indicators of data quality. These indicators will be used to assess the overall quality of the data obtained from this sampling program. Precision is a quantitative measurement of the reproducibility of the data under a given set of conditions. Accuracy is defined as the degree of agreement of a measurement to an accepted reference or true value, and may be indicative of the bias in a measuring system. The degree to which a data set is representative of the study area is known as representativeness. Completeness may be defined as the percentage of valid measurements obtained from a sampling program. Comparability is a qualitative indicator of how well newly collected data will be comparable with previously collected data. The PARCC parameters and their specific applications for the OU-2 Trenches and Mound Site Characterization Work Plan are discussed in Section 3.0.

TABLE 1.2-1
SUMMARY OF HISTORICAL DATA
COLLECTED FROM THE OU-2 TRENCHES AND MOUND SITE

Trench Number	Approximate Depth to Bedrock (ft BGS)(1)	Approximate Depth to High GW (ft BGS)(1)	Near Surface Lithological Unit	Number of Boreholes in IHSS(2)	Number of Subsurface Soil Analyses						Soil Gas Survey	Geotechnical Analysis
					VOCs		SVOCs		Radionuclides			
					Less than 10' BGS	Greater than 10' BGS	Less than 10' BGS	Greater than 10' BGS	Less than 10' BGS	Greater than 10' BGS		
T-1	12	7.5	Qrf	3	3	5	2	3	2	3	---	---
T-2	2-8	3.6	Qc	4	8	12	9	9	9	12	X(3)	---
T-3	15	13.3	Qrf	15	19	38	8	11	8	11	X	X
T-4	18	13.5	Qrf	3	3	19	4	14	4	14	X(3)	X
T-5	16-37	16.2-36.5	Qrf	5	10	22	10	19	10	19	---	---
T-6	12	NA	Qrf	1	1	4	1	1	1	1	---	---
T-7	14-37	14.3-37.7	Qrf	7	12	31	7	25	12	28	---	---
T-8	16-41	16.2-42.1	Qrf	4	8	19	4	10	5	18	---	---
T-9	26	17.2	Qrf	3	5	14	4	7	7	11	---	---
T-10	32	NA	Qrf	1	1	4	2	2	2	3	---	---
T-11	28	16.4	Qrf	3	8	20	7	13	9	15	---	---
T-12	25	9.4	Qrf	3	3	2	None	None	3	1	---	---
T-13	27	NA	Qrf	None	None	None	None	None	None	None	---	---
Mound	7-12	12	Qrf	6	10	20	9	7	9	11	X	---

Explanation:
(1) = Depth range is shown for IHSS that overlie bedrock step (T-5, T-7, T-8)
(2) = Boreholes used to characterize trenches may be outside the IHSS and/or trench boundaries
(3) = Soil gas survey was conducted outside of trench
Qrf = Rocky Flats Alluvium
Qc = Colluvium
NA = No data available

BGS = Below ground surface
GW = Groundwater
VOCs = Volatile organic compounds
SVOCs = Semi-volatile organic compounds



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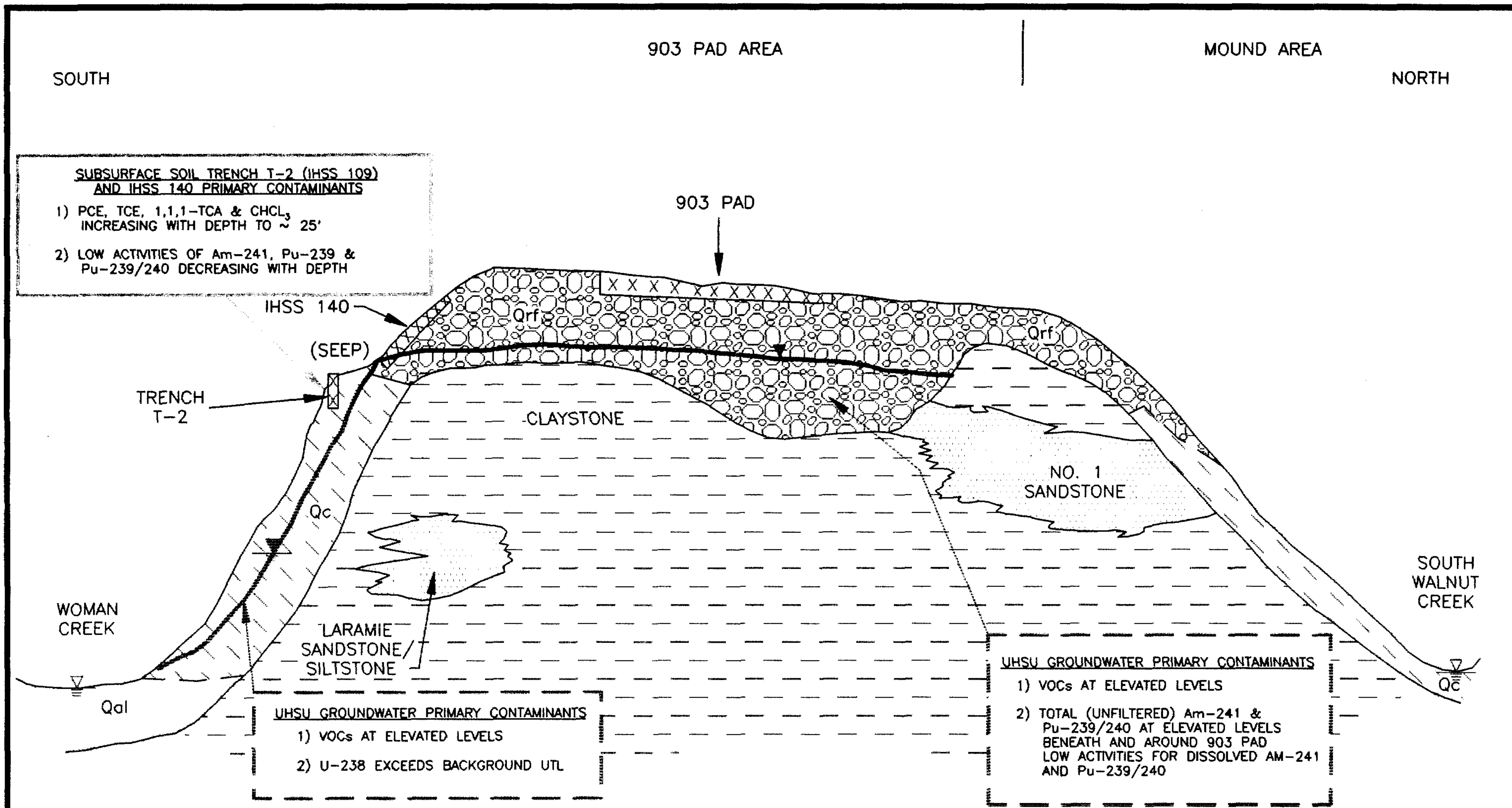
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

LOCATION OF THE ROCKY FLATS
ENVIRONMENTAL TECHNOLOGY SITE

FIGURE 1.1-1 DECEMBER1994

0U2RI803 1=1



EXPLANATION

- SANDSTONE
- COLLUVIUM
- CLAYSTONE
- IHSS BOUNDARY
- Qrf-ROCKY FLATS ALLUVIUM
- SUBSURFACE SOIL
- GROUNDWATER SURFACE
- UHSU GROUNDWATER
- CREEK WATER SURFACE

SOURCE: OU-2 PHASE RFI/RI REPORT

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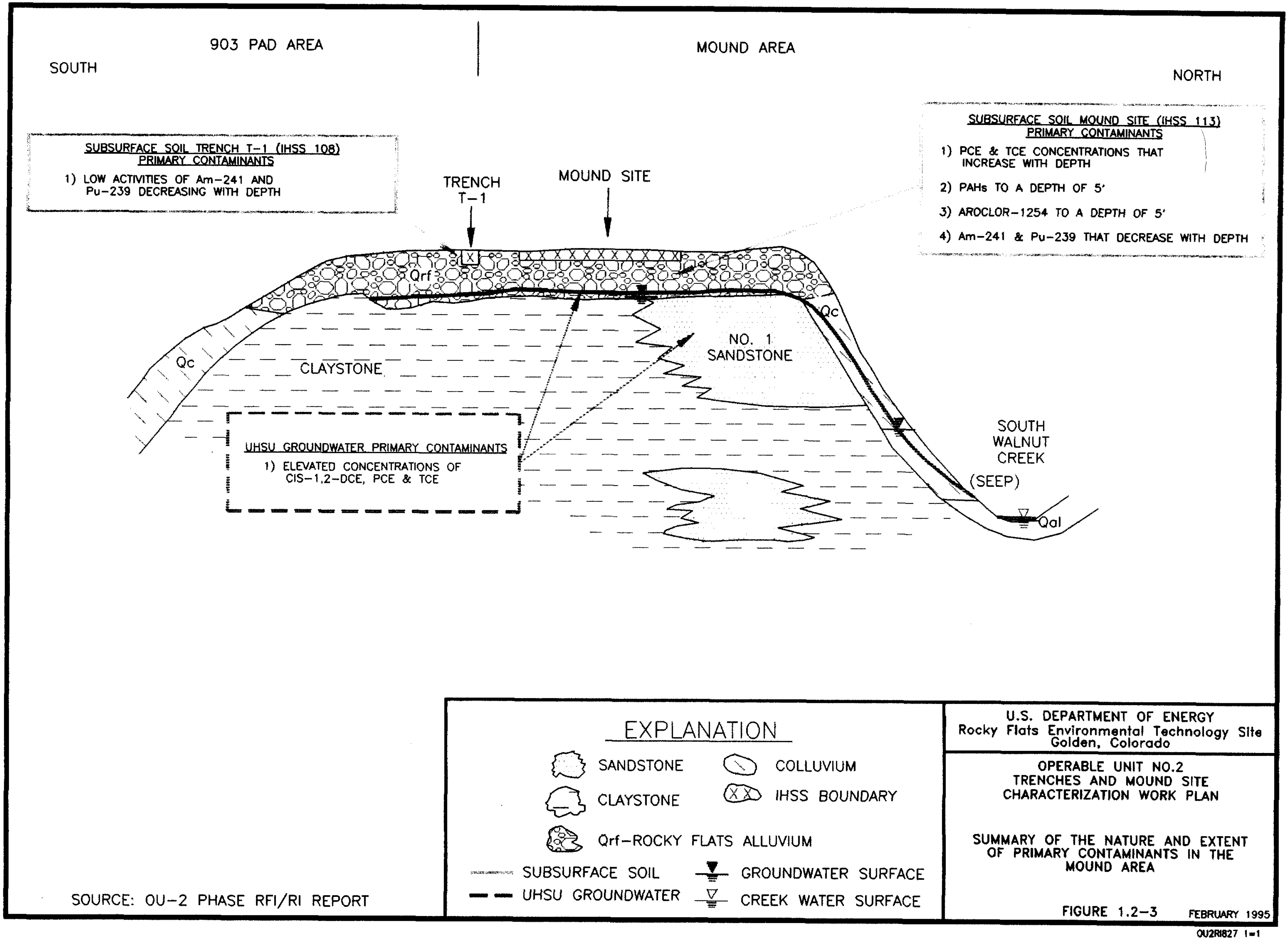
CHARACTERIZATION WORK PLAN

SUMMARY OF THE NATURE AND EXTENT OF THE PRIMARY CONTAMINANTS IN THE 903 PAD AREA

FIGURE 1.2-2 FEBRUARY 1995

OU2R826 1=1



SOUTH
903 PAD AREA
MOUND AREA
NORTH
SUBSURFACE SOIL TRENCH T-1 (IHSS 108) PRIMARY CONTAMINANTS
1) LOW ACTIVITIES OF Am-241 AND Pu-239 DECREASING WITH DEPTH
TRENCH T-1
MOUND SITE
SUBSURFACE SOIL MOUND SITE (IHSS 113) PRIMARY CONTAMINANTS
1) PCE & TCE CONCENTRATIONS THAT INCREASE WITH DEPTH
2) PAHs TO A DEPTH OF 5'
3) AROCLOR-1254 TO A DEPTH OF 5'
4) Am-241 & Pu-239 THAT DECREASE WITH DEPTH
Qrf
Qc
Qc
CLAYSTONE
NO. 1 SANDSTONE
UHSU GROUNDWATER PRIMARY CONTAMINANTS
1) ELEVATED CONCENTRATIONS OF CIS-1,2-DCE, PCE & TCE
SOUTH WALNUT CREEK
(SEEP)
Qal
EXPLANATION
SANDSTONE
COLLUVIUM
CLAYSTONE
IHSS BOUNDARY
Qrf-ROCKY FLATS ALLUVIUM
SUBSURFACE SOIL
GROUNDWATER SURFACE
UHSU GROUNDWATER
CREEK WATER SURFACE
SOURCE: OU-2 PHASE RFI/RI REPORT
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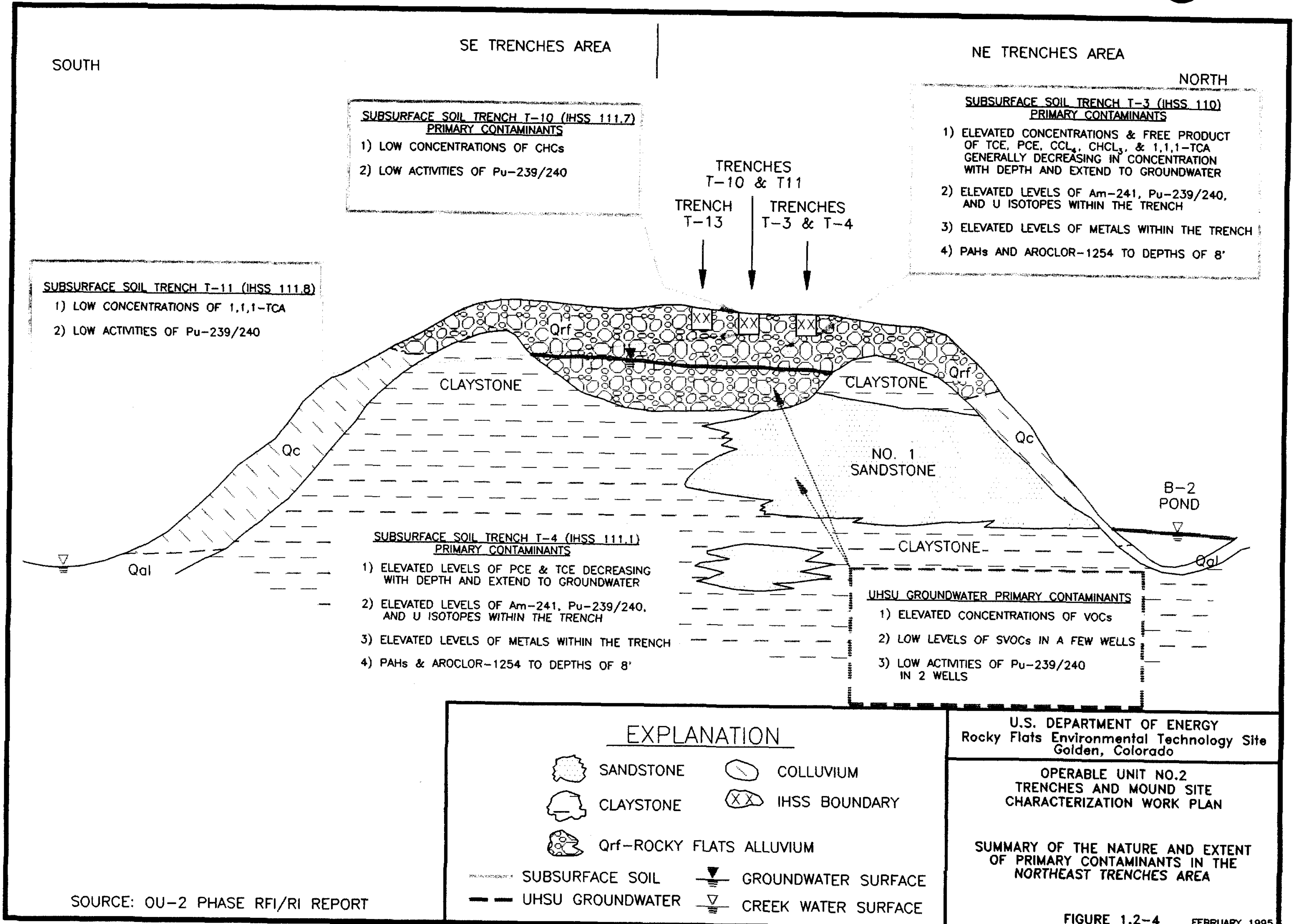
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN
SUMMARY OF THE NATURE AND EXTENT OF PRIMARY CONTAMINANTS IN THE MOUND AREA
FIGURE 1.2-3
FEBRUARY 1995
OU2RI827 1=1


SOUTH
SE TRENCHES AREA
NE TRENCHES AREA
NORTH
SUBSURFACE SOIL TRENCH T-10 (IHSS 111.7) PRIMARY CONTAMINANTS
1) LOW CONCENTRATIONS OF CHCs
2) LOW ACTIVITIES OF Pu-239/240
SUBSURFACE SOIL TRENCH T-3 (IHSS 110) PRIMARY CONTAMINANTS
1) ELEVATED CONCENTRATIONS & FREE PRODUCT OF TCE, PCE, CCL4, CHCL3, & 1,1,1-TCA GENERALLY DECREASING IN CONCENTRATION WITH DEPTH AND EXTEND TO GROUNDWATER
2) ELEVATED LEVELS OF Am-241, Pu-239/240, AND U ISOTOPES WITHIN THE TRENCH
3) ELEVATED LEVELS OF METALS WITHIN THE TRENCH
4) PAHs AND AROCLOR-1254 TO DEPTHS OF 8'
TRENCHES T-10 & T11
TRENCH T-13
TRENCHES T-3 & T-4
SUBSURFACE SOIL TRENCH T-11 (IHSS 111.8)
1) LOW CONCENTRATIONS OF 1,1,1-TCA
2) LOW ACTIVITIES OF Pu-239/240
Qrf
CLAYSTONE
Qc
NO. 1 SANDSTONE
B-2 POND
Qal
SUBSURFACE SOIL TRENCH T-4 (IHSS 111.1) PRIMARY CONTAMINANTS
1) ELEVATED LEVELS OF PCE & TCE DECREASING WITH DEPTH AND EXTEND TO GROUNDWATER
2) ELEVATED LEVELS OF Am-241, Pu-239/240, AND U ISOTOPES WITHIN THE TRENCH
3) ELEVATED LEVELS OF METALS WITHIN THE TRENCH
4) PAHs & AROCLOR-1254 TO DEPTHS OF 8'
UHSU GROUNDWATER PRIMARY CONTAMINANTS
1) ELEVATED CONCENTRATIONS OF VOCs
2) LOW LEVELS OF SVOCs IN A FEW WELLS
3) LOW ACTIVITIES OF Pu-239/240 IN 2 WELLS
EXPLANATION
SANDSTONE
COLLUVIUM
CLAYSTONE
IHSS BOUNDARY
Qrf-ROCKY FLATS ALLUVIUM
SUBSURFACE SOIL
GROUNDWATER SURFACE
UHSU GROUNDWATER
CREEK WATER SURFACE
SOURCE: OU-2 PHASE RFI/RI REPORT
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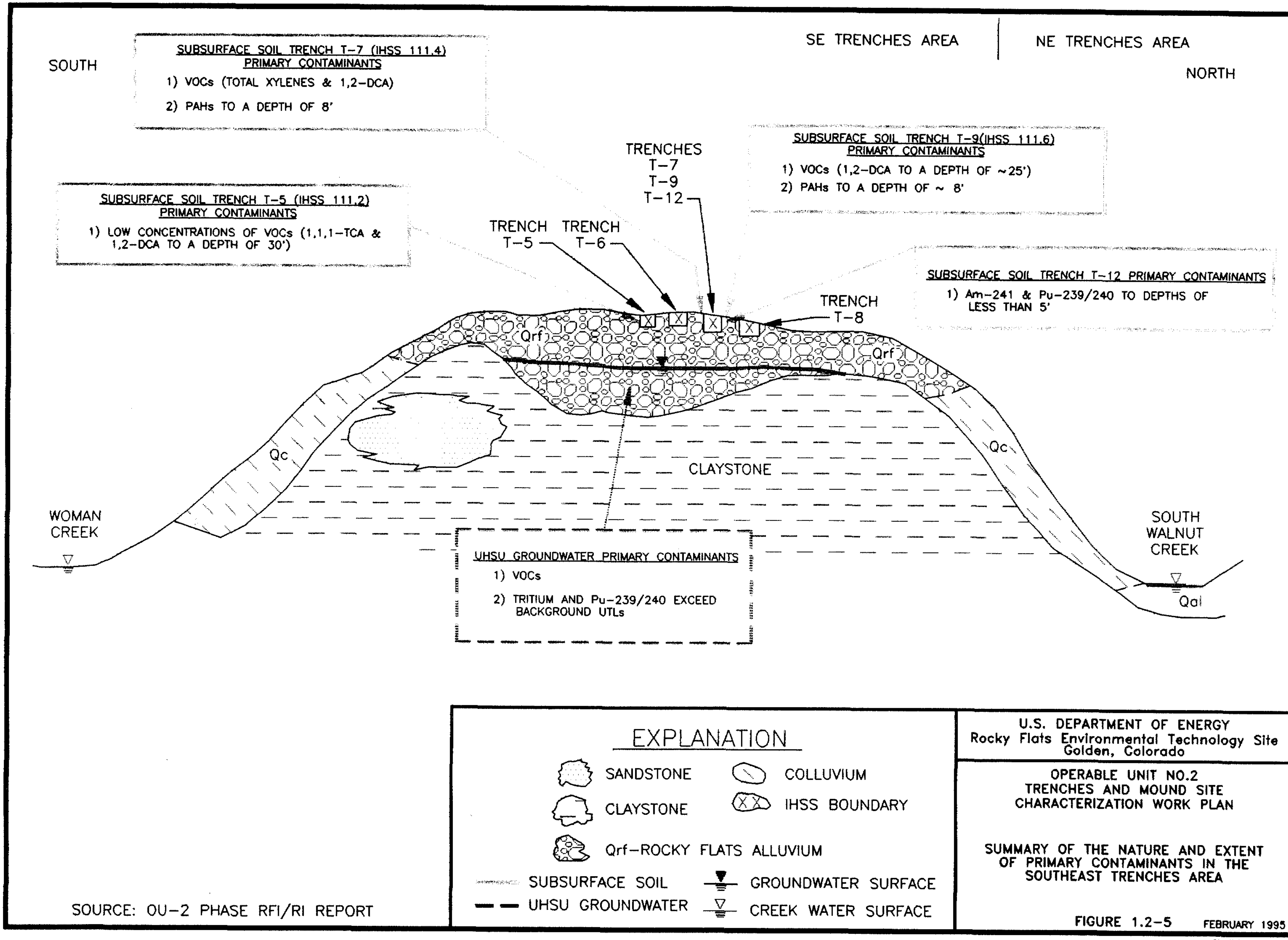
Golden, Colorado
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN
SUMMARY OF THE NATURE AND EXTENT OF PRIMARY CONTAMINANTS IN THE NORTHEAST TRENCHES AREA
FIGURE 1.2-4
FEBRUARY 1995
OU2RI828 1=1



SOURCE: OU-2 PHASE RFI/RI REPORT

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Golden, Colorado

OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

SUMMARY OF THE NATURE AND EXTENT OF PRIMARY CONTAMINANTS IN THE SOUTHEAST TRENCHES AREA

FIGURE 1.2-5 FEBRUARY 1995

OU2RI829 1=1

2.0 SAMPLING AND ANALYSIS PLAN

This section provides the SAP to be implemented for the OU-2 Trenches and Mound Site Characterization Work Plan field investigation program. The purpose of this section of the work plan is to provide a SAP that will address the data needs and describe the work required to fulfill the data quality objectives discussed in Section 1.2.

2.1 PROPOSED WORK

This section describes the proposed investigation objectives, methods, investigation locations, equipment decontamination procedures, sample analysis, and data management for the field investigation of Trenches T-1, T-2, T-4 through T-13 and the Mound Site.

2.1.1 Investigation Objectives

95-DMR-ERM-0027

The objectives of the OU-2 Trenches and Mound Site Characterization Work Plan field investigation program are to: (1) determine the horizontal boundaries of Trenches T-1, T-2, T-4 through T-13 by review of aerial photographs and application of surface geophysical methods in the field, (2) delineate VOC high concentration areas within, in the area surrounding, and potentially beneath Trenches T-1, T-2, T-4 through T-13 and the Mound Site, and (3) identify contaminants within, in the area surrounding, and potentially beneath the trenches and Mound Site. The OU-2 Trenches and Mound Site Characterization Work Plan field investigation program is designed to incorporate an observational approach that will allow the results of the field work to be evaluated as each component is completed, thus guiding the progress and extent of subsequent field work components. As an example, soil gas analyses will be utilized to determine areas of high soil VOC concentrations in the trenches to guide the subsequent collection of subsurface material samples. In this way, the identification of the VOC high concentration areas in the trenches can be expedited, while reducing the potential need for additional later phases of field investigation.

It is anticipated that the OU-2 Trench and Mound Site Characterization Work Plan field investigation program activities can be completed in a period of approximately three to four months following mobilization to the field. A discussion of the anticipated schedule for the OU-2 Trench and Mound Site Characterization Work Plan field investigation program is presented in Section 4.0.

2.1.2 Proposed Investigation Locations and Methods

Trenches T-1, T-2, T-4 through T-13 and the Mound Site in OU-2 will be characterized to determine their dimensions and delineate VOC high concentration areas. The proposed investigation of Trenches T-1, T-2, and T-4 through T-13 and the Mound Site includes the following:

- Review of aerial photographs and pertinent documents from the Historical Release Report for Rocky Flats Plant (DOE 1992b), as discussed in Section 2.1.3.1

- Surface geophysical surveys to identify the approximate trench horizontal dimensions, as discussed in Section 2.1.3.2 (not conducted at Mound Site)

- An initial soil gas screening survey to identify the VOC high concentration areas at depths of 5 and 10 feet below ground surface (bgs), as discussed in Section 2.1.3.3 (not conducted at Mound Site)

- Soil gas survey of additional points to delineate the areal extent of VOC high concentration areas, as discussed in Section 2.1.3.4 (not conducted at Mound Site)

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- Collection of continuous core, subsurface material samples from the center of VOC high concentration areas for chemical and geotechnical analyses, using direct push or hollow-stem auger (HSA) to the base of each trench (assumed to be to a depth of 10 feet bgs with the exception of Trench T-2 which is assumed to be to a depth of 5 feet bgs) as discussed in Section 2.1.3.5 (not conducted at Mound Site)

- Collection of continuous core, subsurface material samples from VOC high concentration areas outside of the trench boundaries for chemical and geotechnical analyses, using HSA techniques to the top of groundwater, as discussed in Section 2.1.3.5

- Potential collection of continuous core, subsurface material samples from beneath the trenches for chemical analyses, using angle drilling techniques to the top of groundwater, as discussed in Section 2.1.3.5

- Collection of continuous core, subsurface material samples using HSA techniques, outside of trench boundaries for Rocky Flats biotreatability as discussed in Section 2.1.3.5

- Collection of NAPL, if encountered in the trenches or Mound Site, as described in Section 2.1.3.6

Figures 2.2-1 through 2.2-4 show the estimated trench locations, the approximate soil gas survey sample locations, and the defined IHSS boundaries for each trench in OU-2. The assumed trench locations and soil gas sampling locations may change after the evaluation of the electromagnetic (EM) and ground penetrating radar (GPR) geophysical data. Also, physical and cultural features (such as large cobbles, roads, underground utilities) may cause relocation of proposed soil gas sampling locations. Underground utilities will be marked prior to commencement of drilling activities. Offsets to the initial soil gas survey line, if necessary, will be along parallel lines.

95-DMR-ERM-0027

95-DMR-ERM-0027

Because drums containing pyroforic uranium are believed to have been disposed of in Trench T-1, intrusive activities will not be performed in Trench T-1 if the EM geophysical survey indicates the presence of buried metallic objects. In this case, methods for intrusive work will be reevaluated. The investigation of Trenches T-12 and T-13 will need to be scheduled to minimize impacts to traffic at Rocky Flats.

2.1.3 Proposed Investigation Activities

2.1.3.1 Aerial Photograph Review of Trenches

Historical aerial photographs of the OU-2 area and appropriate documents referenced in the Historical Release Report for the Rocky Flats Plant (DOE 1992b) will be obtained from the operating contractor and reviewed to evaluate the approximate horizontal boundaries of the trenches and Mound Site. This information will be used to help plan the surface geophysical surveys of the trench boundaries. Historical topographic maps will also be obtained and reviewed as part of this evaluation.

Data from the aerial photograph and document review will be compiled and used to locate the grid lines for the surface geophysical surveys.

2.1.3.2 Surface Geophysical Investigation of Trench Horizontal Boundaries

Surface geophysical methods will be used to help characterize the horizontal dimensions of and the material within each trench in accordance with Rocky Flats SOP GT.18, Surface Geophysical Surveys. Specifically, the geophysical surveys will be used to:

- Obtain information to help estimate the lateral extent of each trench
- Assess the likelihood of buried metallic debris in each trench
- If buried metallic objects are present, assess the distribution of these objects within each trench prior to intrusive activities

The overall goal of the geophysical surveys is to allow optimization of the planned intrusive activities for each trench site investigated.

After review of several potentially applicable surface geophysical methods, a combination of two techniques were selected to accomplish these objectives, including EM and GPR.

2.1.3.2.1 **Electromagnetic Survey**. EM methods provide a rapid means of measuring the electrical conductivity of subsurface materials. EM data can aid the characterization of:

- Lateral extent of trench materials
- Presence and distribution of buried metallic objects
- Depth and thickness of subsurface units

For these investigations, EM data will be collected with a Geonics EM-31 Terrain Conductivity Meter (EM-31). Using the EM-31, the depth of investigation is dependent on the instrument mode of operation. It can be operated in two modes or coil orientations; the horizontal dipole mode (coils are vertical coplanar), which has a penetration depth of approximately 7 to 8 feet, and the vertical dipole mode (coils are horizontal coplanar) which has a penetration depth of 15 to 16 feet. EM data will be collected using both modes to address vertical conductivity variations in the near-surface materials.

Additionally, we plan to measure both the quadrature phase component and the inphase component of the induced magnetic field. The quadrature phase is linearly related to the ground conductivity and therefore directly responsive to geologic variations. The inphase component measures the ratio of the induced magnetic field to the primary field, and as a result is more responsive to the presence of metallic objects than the quadrature phase.

EM data will be collected in a grid pattern over each trench. The station spacing for EM data collection will nominally be 5 feet. The station spacing of 5 feet was chosen to allow potential resolution of trench edges. A significantly larger station spacing would likely make the interpretation of trench edges more ambiguous. All EM data will be collected using a data logger to facilitate preliminary plotting and interpretation.

Conductivity values for each mode of operation will be plotted and contoured to evaluate the conductivity variations across the survey area. Variations in the subsurface conductivity resulting from buried metallic objects or disturbed soil materials will be identified. All anomalies will be correlated with cultural features, such as surface debris, buried utilities, overhead utilities and communications apparatus, or any large metal structures in close proximity to the survey area.

In some anomalous areas of the investigated trenches that appear to have metallic debris based on preliminary EM results, further definition of those areas may be accomplished using a Geonics EM-61. The EM-61, which is a time-domain EM metal detector, will be used to more accurately define lateral limits of buried metallic debris. The EM-61 will likely be used over a small percentage of each trench location at the discretion of, and documented by, the field geophysicist. Results of the preliminary EM plotting and interpretation will be used to refine (if necessary) the planned GPR survey.

2.1.3.2.2 **Ground Penetrating Radar Survey.** GPR using impulse radar technology has recently been developed and applied for the non-intrusive investigation of shallow subsurface materials. The method has been used for delineating near-surface soil layering, locating voids in concrete or limestone, finding buried pipeline or reinforcement bars, mapping shallow geologic interfaces, and determining disturbed soils.

GPR involves transmitting a relatively high-frequency electromagnetic pulse using a transducer antenna into the medium, and recording reflected electromagnetics energy with a receiving antenna. Electromagnetic reflections occur whenever the dielectric constant of the material(s) changes. As the antenna is towed along a survey line, the reflected electromagnetic signals are displayed as travel times on a graphic recorder, which prints an approximation of the interfaces one would see in cross-section. The GPR data are printed using the graphic recorder, and recorded digitally.

The ultimate effectiveness of GPR at a given site is directly proportional to the dielectric properties of the medium through which the signal is transmitted. GPR allows the greatest resolution of subsurface features when favorable conditions exist. However, properties of the medium can affect penetration depths. These depths are primarily controlled by the electrical conductivity of the surveyed medium because the electromagnetic pulses lose energy in the form of heat when transmitted through electrically conductive units. For example, the prevalence of conductive soils such as clay can reduce GPR penetration depths, and in some cases, render GPR ineffective.

In previous GPR work at Rocky Flats, the existence of near-surface clay has reduced overall penetration and effectiveness of GPR. However, GPR has shown to be effective within the upper several feet of soil, which is usually sufficient to detect the existence of a trench.

Weather conditions can also affect GPR results. Experience has shown that in some cases, GPR data cannot be collected in significant rainy conditions. Results can also be rather dubious in melting snow conditions, where near-surface water content is quite variable. However, reliable GPR data can usually be collected in areas where a uniform thickness of snow cover exists. Because of these potential effects, it will be important to conduct the GPR survey over a given trench location under as consistent weather conditions as possible to optimize GPR results.

GPR data will generally be collected perpendicular to the long axis of the suspected trench orientations. Each trench orientation will be estimated based on historical information as well as the EM results. Individual GPR transects will be completed with a nominal separation of 10 feet between transects, and will be conducted along a similar orientation as the EM lines to facilitate correlation between the two methodologies.

Individual GPR transects will be interpreted as the data are collected by an experienced GPR interpreter. Based on correlation of the EM results and GPR data, an interpreted estimate of the trench horizontal boundaries will be made and staked in the field. In addition, zones in which buried metallic debris are indicated by the geophysics, and that could be encountered during intrusive activities, will be identified and plotted on preliminary survey grid output maps for each investigated trench. The preliminary plotting and staking of interpreted trench boundaries will assist in locating the initial soil gas sampling locations. The location of trench boundaries as interpreted by the geophysical surveys will later be surveyed by Rocky Flats personnel in accordance with Rocky Flats SOP GT.17, Land Surveying.

2.1.3.3 Soil Gas Survey

After the trench horizontal dimensions have been delineated by the aerial photography review and EM and GPR geophysical surveys and the trench boundaries have been surveyed by Rocky Flats personnel, a soil gas sampling grid will be laid out. A soil gas screening survey will then be conducted on a grid over each trench to identify VOC high concentration areas to guide subsequent soil gas and subsurface material sampling. The soil gas survey will be performed on a 20-foot spacing along two parallel lines running the length of the major axis of each trench. Soil gas samples will be collected at two depths (5 and 10 feet bgs) at each sampling location.

Soil gas samples will be collected in accordance with Rocky Flats SOP GT.09, Soil Gas Sampling and Field Analyses. The following are the procedures that will be used to obtain soil gas samples:

1. The southwest corner of the trench as determined by the aerial photograph review and EM and GPR geophysical investigations will be surveyed by Rocky Flats personnel using the global position system (GPS).

2. The initial soil gas sampling location grid will be laid out on a 20-foot spacing centered along the long axis of the trench from the southwest corner. The sample location numbers will be assigned by the Rocky Flats Environmental Database System (RFEDS) group.

   All location information will be recorded in the logbook and applicable field forms. Soil gas grid sampling locations will be cleared in accordance with Rocky Flats SOP GT.10, Borehole Clearing.

3. Calibrate PID and FID prior to arrival at the site.

4. Decontaminate all downhole equipment prior to use at each sampling location, as discussed in Section 2.2.

5. Direct push retractable tip soil gas sampler to desired depth (either at 5 or 10 feet bgs).

6. Prepare and insert post-run tubing system.

7. Insert a development syringe and remove three probe volumes.

8. Insert sample collection syringe and obtain PID and/or FID reading on all soil gas samples. Operation and maintenance of organic vapor analyzers (OVAs) will be in accordance with Rocky Flats SOP FO.15, Photoionization Detectors and Flame-Ionization Detectors. The PID and/or FID readings will be recorded onto a data logger, recorded in the logbook and on applicable field data forms after each sample is obtained in accordance with Rocky Flats SOP FO.14, Field Data Management. The data loggers will be downloaded at the end of each day. For approximately 30 percent of the sample locations, collect a discrete sample with a syringe needle and transfer into a glass bulb for confirmation analyses (a modified Method 8010 [SW-846]) by the on-site mobile laboratory. The soil gas samples to be submitted for analyses by a modified Method 8010 (SW-846) will be determined using random number generation.

9. Remove the post-run tubing system. Inspect the system to verify that the retractable tip sampler was properly assembled.

10. Grout soil gas sampling probe borehole according to Rocky Flats SOP GT.05, Plugging and Abandonment of Boreholes.

11. All data collected will be recorded in the logbooks and on applicable field data forms as specified in Rocky Flats SOP FO.14, Field Data Management.

12. Initial soil gas survey data will be hand plotted and the soil gas concentrations contoured to determine the VOC high concentration areas within each trench. The evaluation and mapping of initial soil gas data will occur prior to obtaining the VOC high concentration soil gas samples and subsurface soil samples.

2.1.3.4 High Concentration Area Soil Gas Survey

Once the VOC high concentration areas have been identified, additional soil gas samples will be collected in the surrounding areas as necessary to delineate the areal extent of the high concentration areas. The high concentration area delineation soil gas samples will be collected at the same depth as was observed by the screening soil gas survey using the same collection procedures as discussed in Section 2.1.3.3 and will be field screened with a PID and/or FID. Like the initial soil gas samples, approximately 30 percent of the high concentration area delineation soil gas samples will be submitted for on-site laboratory confirmation analyses using a modified Method 8010 (SW-846), as discussed in Section 2.3.1. At a minimum, four soil gas sample locations will be placed around each high concentration area to estimate the lateral extent and orientation of the VOC high concentration areas. The location numbers will be assigned by the RFEDS group. The high VOC concentration area soil gas sampling locations will be measured from the southwest corner of the trench.

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2.1.3.5 High Concentration Area Subsurface Material Sampling

After identifying and determining the estimated VOC high concentration area(s) in a trench, the data collected will be evaluated along with historical borehole data to determine the number and location of subsurface material sample(s) according to information shown on Figure 1.2-6. The following criteria will be used to determine the number of boreholes for the trenches:

- If the VOC high concentration area, as defined by the soil gas survey, is less than 20 feet in diameter, then two shallow boreholes will be drilled and sampled.

- If the VOC high concentration area, as defined by the soil gas survey, is greater than 20 feet in diameter, then three shallow boreholes will be drilled and sampled.

- If an existing historical borehole is located within 10 feet of the VOC high concentration, as defined by the soil gas survey, then a shallow borehole may be eliminated.

The following information will be assessed to help locate boreholes for the trenches:

- The areal extent of VOC high concentration area
- The number and location of previous boreholes drilled in the VOC high concentration area
- The type of contaminant(s) and concentration(s) in the VOC high concentration area
- The depth to high groundwater (as measured during 2nd quarter 1992 from nearby wells)
- The depth to groundwater (as measured at the beginning of the quarter from nearby wells)
- The location of groundwater plumes
- Field observations (NAPL, drums, void spaces)

Shallow boreholes will be pushed using a micro-sampler probe drive system or drilling using HSA techniques to an approximate depth of 10 feet bgs. The borehole locations will be cleared prior to drilling in accordance with Rocky Flats SOP GT.10, Borehole Clearing. The micro-sampler will be lined with either polybutyrate or stainless steel, depending on the type of analysis required. Continuous core will be collected from each borehole. Two discrete subsurface material samples (soil, sludge, or liquid) for VOC analysis and two composite samples for SVOC, metals, and select radionuclide analysis will be collected from each

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shallow borehole. The select radionuclides will be gross alpha; gross beta; Am-241; Pu-234/240; U-233,-234; U-235; and U-238. The two discrete VOC samples will be collected at approximate depths of five and ten feet bgs. The depths of five and ten feet are to obtain samples at the base of the trenches (assumed to be ten feet) and a sample in the mid point of the trench (assumed to be five feet). The VOC sample collected from the shallow borehole will be submitted for rush turnaround analysis (24 to 48 hours). Composite SVOC, metal, and select radionuclide samples will be obtained from approximate depths of three to five feet and eight to ten feet bgs from each shallow borehole.

Four boreholes will be drilled and sampled in the Mound Site (IHSS 113) to the top of bedrock or where groundwater is encountered if above the top of bedrock (assumed to be a depth of approximately 15 feet). Figure 2.2-1 shows the approximate location of these boreholes. Two boreholes will be drilled in each of two VOC high concentration areas observed during the previous soil gas survey at the Mound Site. The VOC high concentration areas are located in the northeast and northwest sides of the Mound Site. One borehole will be located in the center of the VOC high concentration area and the other will be located approximately 10 to 20 feet north, in the hydraulically downgradient direction. Continuous core will be collected from each borehole. Three discrete subsurface material samples for VOC analysis and two composite samples for SVOC, metals, and select radionuclide analysis will be collected from each borehole. The three discrete VOC samples will be collected at approxiamte depths of five, ten, and fifteen feet bgs. Composite samples will be obtained from approximate depths of 9 to 10 feet and 14 to 15 feet bgs.

The deep HSA boreholes and the angle borehole locations will be determined after meeting with EG&G and DOE representatives. The locations will be identified after evaluating the following information:

- The areal extent of VOC high concentration areas as identified by the soil gas survey
- The location of historical boreholes
- The VOC analytical results obtained from the shallow boreholes within the trenches
- The depth to high groundwater from nearby wells (as measured during 2nd quarter of 1992)
- The depth to groundwater from nearby wells (as measured during the quarter that the drilling will be performed)
- The location of contaminated groundwater plumes

- Field observations (i.e., NAPL, drums, void spaces)

Deep boreholes may be drilled outside of the trenches to the top of groundwater using hollow-stem auger (HSA) techniques. The borehole locations will be cleared prior to drilling in accordance with Rocky Flats SOP GT.10, Borehole Clearing. Boreholes will be drilled and sampled according to Rocky Flats SOP GT.02, Drilling and Sampling Using Hollow-Stem Auger Techniques. Continuous core will be obtained from each borehole. Discrete VOC samples will be obtained at a five-foot interval (i.e., 5, 10, 15...) down to the top of groundwater. Three composite samples for SVOC, metals, and select radionuclides will be collected down to the top of groundwater. Composite SVOC, metal, and select radionuclide samples will be obtained from approximate depths of three to five feet bgs and eight to ten feet bgs from each deep borehole. In addition, a composite sample will be collected from each trench at a depth of two feet above the high groundwater level (as measured in second quarter of 1992) and analyzed for SVOCs, metals, and select radionuclides.

Boreholes may be drilled beneath the bottom of the trenches to the top of groundwater using angle drilling techniques. The borehole locations will be cleared prior to drilling in accordance with Rocky Flats SOP GT.10, Borehole Clearing. Boreholes will be drilled and sampled according to Rocky Flats SOP GT.02, Drilling and Sampling Using Hollow-Stem Auger Techniques. Continuous core will be obtained from each borehole. Two discrete samples for VOC analysis and two composite samples for SVOC, metal, and select radionuclide analysis will be collected from each borehole at depths beneath the estimated base of the trench.

For all samples, the composite intervals may be altered in the field by the amount of core recovered in each splitspoon sampler. The priority for sample collection will be as follows:

- SVOCs
- Select radionuclides
- Metals

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If there is not enough core obtained to perform these analyses, then core collected at different depths will be sampled to collect the required amount to perform the analyses.

The core from shallow and deep borings will be screened for VOCs with the PID and/or FID in accordance with Rocky Flats SOP FO.15, Photoionization Detectors and Flame-Ionization

Detectors, and for radiological contaminants in accordance with Rocky Flats SOP FO.16, Field Radiological Measurements. After the core has been field screened, it will be visually logged by the field geologist and inspected for discolored or stained materials. Core samples submitted for laboratory analysis will be handled in accordance with Rocky Flats SOP FO.10, Receiving, Labeling, and Handling Environmental Material Containers, and Rocky Flats SOP FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples. Depths of sampling may be altered if the field screening or visual inspection indicates the presence of contamination at depths other than those specified. If discolored or stained materials is encountered, then it will be sampled and analyzed for total petroleum hydrocarbon (TPH) by modified Method 8015 (SW-846). Table 2.3-1 presents the analytical methods and the sample container requirements for each analysis type.

Samples will be collected in accordance with Rocky Flats SOPs FO.10, Receiving, Labeling, and Handling Environmental Materials Containers, and FO.13, Containerization, Preserving, Handling, and Shipping of Soil and Water Samples. Drill cuttings will be handled in accordance with Rocky Flats SOP FO.08, Handling of Drilling Fluids and Cuttings. The boreholes will be plugged and abandoned in accordance with Rocky Flats SOP GT.05, Plugging and Abandonment of Boreholes.

Two biotreatability samples will be collected from core obtained from the subsurface material in both the saturated and unsaturated (vadose) zones during the OU-2 Trenches and Mound Site Characterization. These biotreatability samples will be used by the operating contractor to evaluate the chlorinated solvent degraders.

The unsaturated (vadose) zone subsurface material will be collected from an area with less than 1 mg/kg of total VOCs as determined in the field by the PID and/or FID. Based on historical information as presented in the OU-2 Phase II RFI/RI Report, the borehole for collecting the unsaturated biotreatability samples will most likely be collected from a trench in the Southeast Trenches Area of OU-2. The saturated (aquifer sediments) subsurface soil materials should be collected from an area which has between 1 mg/l and 100 mg/l of Total VOCs. Based on the review of the isoconcentration map prepared for the OU-2 Phase II

RFI/RI Report, the borehole for collecting the saturated biotreatability samples will be collected from either Trench T-2, Trench T-4, or Trench T-12. Saturated Rocky Flats Alluvium is preferred over saturated bedrock.

Approximately one to two Kg (approximately three feet of core) is required to perform the analysis. The core will be inspected after collection by the Environmental Research Engineer to determine if the core is suitable. The core will be placed into sterile packing, which is to be provided by the Environmental Research Engineer. The samples will be stored at 4°C. All biotreatability samples will have a radionuclide screen performed prior to shipment to the biotreatability laboratory.

In addition to the analytical samples, geotechnical samples will be collected from selected trenches and/or the Mound Site. Physical properties of the subsurface materials are needed for the EE/CA. These properties need to be collected from both the disturbed material in the trenches as well as the surrounding undisturbed subsurface material. The geotechnical sample locations will be colocated with subsurface material chemical sample locations. The geotechnical methods are discussed in Section 2.3.3. Discrete geotechnical samples will be obtained from a depth of three to eight feet and are dependent on the amount of core recovered. Approximately 1.5 feet of continuous core is required to perform the suite of geotechnical analyses. Geotechnical samples will be collected in either polybutyrate or stainless steel liners. A total of eight geotechnical samples will be collected from the following trenches or site depending on the recovery of samples:

- The Mound Site or Trench T-1
- Trench T-2
- Trench T-4
- Trench T-5 or Trench T-6
- Trench T-7 or Trench T-8
- Trench T-9
- Trench T-10 or Trench T-11
- Trench T-12 or Trench T-13

Where trenches are near each other, only one sample will be collected, which represents both trenches.

Subsurface material sampling locations will be plugged and abandoned in accordance with Rocky Flats SOP GT.05, Plugging and Abandonment of Boreholes.

2.1.3.6 High Concentration Area Geoprobe Liquid (NAPL) Sampling

If NAPL is encountered in the shallow direct push locations or deep HSA boreholes, a sample of the NAPL will be collected for analysis. Section 2.3.4 discusses the analyses for NAPL samples. To collect a sample of NAPL, the direct push equipment will be removed and a retractable screen point sampler equipped with tubing and a peristaltic pump will be used to extract the NAPL. A bailer may be used to collect a NAPL sample for the hollow stem auger boreholes. If for some reason, a NAPL sample cannot be collected in the borehole where it was encountered (e.g., due to low permeability), a second probe located one to two feet from the original boring will be advanced to the same depth as the depth where NAPL was encountered in the original boring. If NAPL is present, an attempt will be made to collect the NAPL in the second boring. If NAPL is not present at that depth or collection of NAPL is not successful, the sampler will be advanced approximately two feet and another effort made to locate and retrieve the NAPL sample. If NAPL cannot be sampled using the above methods, the locations will be abandoned. NAPL samples will be analyzed for VOCs, SVOCs, TPH, metals, and selected radionuclides (gross alpha, gross beta, Am-241, Pu-234/240, U-233,-234, U-234, and U-238).

2.2 EQUIPMENT DECONTAMINATION

Equipment decontamination will be conducted on all drilling, sampling and direct push equipment utilized in the field investigation program. All sample collection equipment will be decontaminated between sample collection locations and discrete subsurface sampling depths in accordance with Rocky Flats SOP FO.03, General Equipment Decontamination.

Either a full or a partial decontamination procedure will be performed depending on the type of equipment and the location of the field activity. Full decontamination consists of decontamination of the entire direct push rig and associated equipment in accordance with Rocky Flats SOP FO.04, Heavy Equipment Decontamination. Associated equipment consists of augers, drilling rods and bits, bolts, racks, tools, rods, and sample decontamination tubs.

The following summarizes situations requiring a full decontamination of all downhole sampling equipment and the direct push rig:

- When the rig is moving from one IHSS area (group of IHSSs) to another (i.e., Mound Site, 903 Pad Area, Northeast Trenches, Southeast Trenches)

- When the rig is moving from the Mound Site to a trench or if the rig is moving from a trench to the Mound Site

Partial decontamination consists of decontamination of downhole direct push equipment and the back of the direct push rig. Partial decontamination will be performed at the drilling site prior to moving between sampling locations within a trench (i.e., between soil gas sampling locations, soil samples, and borehole soil samples).

The following summarizes situations requiring a partial decontamination of the downhole equipment:

- When the rig is moving from one trench to another trench in the same IHSS area.

- Soil sampling device will be decontaminated after each sampling event.

- Soil sampling device will be decontaminated between each location.

- Borehole split spoon samplers will be decontaminated after each sampling event.

- Hollow-stem augers will be decontaminated between boreholes.

Additional decontamination requirements include:

- Except for decontamination of sampling equipment between sampling depths, decontamination will be conducted at the main decontamination facility.

- The contractor will be required to attend decontamination training and will provide laborers to support the decontamination facility operation.

- Direct push rigs will be required to be decontaminated when they are first brought onto the site and immediately prior to demobilization.

- Non-intrusive equipment will not be decontaminated (i.e., geophysical survey equipment).

2.3 SAMPLE ANALYSIS

The following sections provide information on the sample types, analytical methods, sampling containers, preservation requirements, analytical holding times, and the proposed number of samples to be obtained for each media. The sample handling and shipping will be performed in accordance with Rocky Flats SOPs FO.10, Receiving, Labeling, and Handling Environmental Material Containers, and FO.13 Containerization, Preserving, Handling, and Shipping of Soil and Water Samples, respectively.

2.3.1 Soil Gas Samples

All soil gas samples collected will be field screened with the PID and/or FID. Approximately 30 percent of the soil gas survey sample locations will be selected at random and samples collected for on-site mobile laboratory confirmation analysis for VOCs by modified Method 8010 (SW-846) (Table 2.3-1). Specific samples to be analyzed by modified Method 8010 (SW-846) will be determined by random number generation. The purpose of the on-site laboratory confirmation analyses is to provide an indication of the reliability of the field screening methods. The sample collection procedures are discussed in Section 2.1.3.3.

2.3.2 Subsurface Material Chemical Samples

Subsurface material samples will be collected from boreholes in the Mound Site and from the VOC high concentration area locations in the trenches as determined by the initial soil gas survey and VOC high concentration area soil gas surveys. The subsurface material samples will be field screened and analyzed at an offsite laboratory for VOCs by modified Method 8240 (SW-846) with tentative identified compounds (TICs) reported; SVOCs by Method 8270 (SW-846) with TICs reported; metals by Method 6010; and select radionuclides (gross alpha, gross beta, americium-241, plutonium-239/240, uranium-233/234, uranium-235, and uranium-238). In addition to these analyses, total petroleum hydrocarbon (TPH) analysis by modified Method 8015 (SW-846) for both purgeable and extractable fractions will be performed if discolored or stained material is observed. Field blanks and duplicates will be collected at a rate of five percent of the total samples collected. The analytical methods, containers, preservation, and holding time requirements are presented on Table 2.3-1. Section 2.1.3.5 describes where and how these samples are to be collected.

2.3.3 Subsurface Material Geotechnical Samples

Geotechnical samples will be collected to evaluate the physical properties of the subsurface material in and around the trenches and the Mound Site. Eight geotechnical samples will be collected. Section 2.1.3.5 provides rationale for the sample locations. A suite of geotechnical tests will consist of the following:

- Moisture Content (ASTM Method D-2216)
- Grain Size (ASTM Method D-422)
- Soil Porosity
- Dry Density (ASTM Method D-2937)
- Triaxial Permeability (ASTM Method D-5084)

2.3.4 Liquid (NAPL) Samples

If NAPL is encountered during any of the investigations, the NAPL will be sampled and analyzed at an off-site laboratory for VOCs by Method 8240 (SW-846) with TICs reported; SVOCs by Method 8270 (SW-846) with TICs reported; TPH by modified Method 8015 (SW-846) purgeable and extractable; metals by Method 6010; and select radionuclides (gross alpha, gross beta, americium-241, plutonium-239/240, uranium-233/234, uranium-235, and uranium-238). Section 2.1.3.6 describes how and where the NAPL samples will be collected. The analytical methods, containers, preservation, and holding time requirements are presented on Table 2.3-1.

2.4 DATA MANAGEMENT

Subsurface material and NAPL samples, corresponding field data, and laboratory data collected during the OU-2 Trenches and Mound Site Characterization Work Plan field investigation program will be incorporated into the RFEDS. The RFEDS is used to track, store, and retrieve project data. Data will be captured in Datacap 3.0 and periodically transmitted to the RFEDS via diskette subsequent to data validation as outlined in the ER Program Quality Assurance Project Plan (QAPjP) (DOE 1990 and 1992a) and SOP FO.14, Field Data Management. Hardcopy reports will then be generated from the system for data interpretation and evaluation. Survey coordinates of new location codes will be transmitted to the RFEDS/GIS groups via diskette. Field screening data will be entered into EXCEL spreadsheets for tracking and reporting. Field screening data will include PID, FID, and radiological instrument readings, sample location, sample depth, air temperature, and weather conditions. While in the field, an EXCEL spreadsheet will also be used to track the investigative, confirmation, and field QC samples collected. The field QC sample collection frequency is specified in Section 3.0.

TABLE 2.3-1

SAMPLING CONTAINER AND PRESERVATION REQUIREMENTS

Media	Method	Container Size and Type	Preservative	Holding Time*	Approximate Number of Samples
Soil Gas	modified 8010 (1)	Glass Bulb	4 C	24 hours	200
Subsurface Material	8240 (1) with TICs	Stainless Steel Liner	4 C	14 days	151
Subsurface Material	8270 (1) with TICs	16 oz. glass	4 C	14 days	138
Subsurface Material	modified 8015 (1)	16 oz. glass (SVOC)	4 C	14 days	If discolored or stained
		4 oz. glass (VOC)	4 C	14 days	material is observed
Subsurface Material	Select Radionuclides (2)	16 oz. glass	None	6 months	138
Subsurface Material	6010 (1)	16 oz. glass	None	6 months (28 days for mercury)	138
NAPL	8240 (1) with TICs	2-40 ml vials	4 C	7 days	If NAPL is encountered
NAPL	8270 (1) with TICs	2-1L amber glass	4 C	7 days	If NAPL is encountered
NAPL	modified 8015 (1)	1-1L amber glass (SVOC)	4 C	7 days	If NAPL is encountered
		3-40ml. VOA vials (VOC)	4 C	14 days	If NAPL is encountered
NAPL	Select Radionuclides (2)	1-1L Poly	None	6 months	If NAPL is encountered
NAPL	6010 (1)	8 oz. glass	None	6 months (28 days for mercury)	If NAPL is encountered

(1) U.S. EPA SW-846 methods
(2) Select Radionuclides include gross alpha, gross beta, Am-241, Pu-239/240, U-233/234, U-235 and U-238
* Holding times are from time of collection to preparation and/or analysis.

3.0 QUALITY ASSURANCE PROJECT PLAN (QAPjP)

The QAPjP is an element of the work plan that identifies specific SOPs, the reporting and quality control (QC) criteria for each analytical method, the collection frequency and type of field QC samples required, and the data quality objectives of the PARCC parameters. The objective of the QAPjP is to provide guidelines specifically designed to optimize the quality of the sampling process and analytical data obtained for the sampling program defined in the work plan. These guidelines facilitate obtaining consistent and reliable data throughout the sampling program. This process also provides definition and documentation of the PARCC parameters with respect to the sampling program.

This QAPjP is based on the Environmental Restoration (ER) Program QAPjP which was prepared by the operating contractor and submitted to the EPA and CDPHE for comment and review. The SOPs identified in this QAPjP were prepared by the operating contractor and submitted to the Environmental Protection Agency (EPA) and the Colorado Department of Public Health and Environment (CDPHE) for review and comment. All field and analytical procedures will be performed in accordance with the methods described in the QAPjP and the referenced SOPs unless otherwise specified. New SOPs will be developed, reviewed, and approved as needed.

3.1 QUALITY CONTROL

Field and laboratory QC samples will be collected and prepared in conjunction with the investigative and confirmation samples to provide information on data quality. Section 3.1.1 briefly describes the type of QC samples and procedures that are related to the laboratory, and Section 3.1.2 describes the field QC samples that will be collected at the sampling site.

3.1.1 Laboratory QC

The types of laboratory QC samples, and the QC criteria required for each analysis, are specified in the General Radiochemistry and Routine Analytical Services Protocol (GRRASP)

(DOE 1990b). Laboratory QC samples include method blanks and laboratory blank spikes. These control samples are prepared and analyzed at regular intervals and demonstrate whether or not analytical conditions are within acceptable limits. Laboratory control procedures also include spiking field samples with known quantities of target analyte and/or surrogates (tracers for radionuclides). Results from spiked field samples provide an estimate of recovery bias associated with the matrix. The results of the laboratory QC data, as summarized here, are evaluated during data validation by the Rocky Flats validation contractor. The validation guidelines are contained in the document entitled Data Validation Functional Guidelines, prepared by the operating contractor, ER Department, Environmental Monitoring and Assessment Division (DOE 1990a). The guidelines are comprised of EPA-CLP criteria, as well as criteria developed by the operating contractor for non-standard analyses such as radiochemistry. New guidelines and criteria will be developed, reviewed, and approved as needed.

3.1.2 Field QC Samples

Equipment rinsate blanks, trip blanks, field duplicates, matrix spike/matrix spike duplicates (MS/MSD), laboratory replicates (LR) for radionuclides, and ambient blanks are the field QC samples that have been identified for the OU-2 Trenches and Mound Site field investigation. Table 3.1-1 specifies the collection frequency for field QC samples. The GRRASP identifies the laboratory as responsible for ensuring that MS/MSD and LR samples are prepared and analyzed at specified frequencies; however, since these QC samples originate from investigative samples, the field sampling crew must collect sufficient sample for the laboratory to prepare additional aliquots (see Sections 3.1.2.4 and 3.1.2.5). The field QC samples and their purpose are defined in the following sections. The collection and/or preparation of each field QC sample is governed by specific SOPS prepared by the operating contractor.

3.1.2.1 Equipment Rinsate Blanks

Equipment rinsate blanks are typically collected by pouring distilled/deionized water through decontaminated sample collection equipment and submitting the sample for the same analyses as the investigative samples. The possible introduction of contaminants into environmental samples during collection and handling is evaluated using data obtained from equipment rinsate blanks. These rinsates will be collected at a frequency of 1 in 20 investigative samples, per matrix (not including soil gas), or once per day, whichever is more frequent.

Equipment rinsates will be considered acceptable (with no need for data qualification) if the concentration of target analyte(s) is less than three times the required detection limit (DOE 1991d). The results of this evaluation will be presented as part of the Representativeness assessment (see Section 1.2.7.5).

3.1.2.2 Trip Blanks

Trip blanks are prepared by the laboratory, typically using laboratory-grade carbon filtered water, and sent to the sampling site with empty sampling containers. Trip blanks pertain only to VOCs; therefore, they are handled the same as samples collected for VOC analysis. The trip blanks are carried in the field during collection of investigative samples, labeled in the field, and then returned to the laboratory with the investigative samples. The trip blanks remain un-opened until analysis. One trip blank per shipping cooler (containing VOC sampling containers) will be provided, and the trip blanks will only be analyzed if VOCs are detected in the investigative samples, or if breakage occurs during shipping. Trip blanks will not be analyzed for soil gas samples. Trip blanks are used to assess possible contamination originating from sample transport, to and from the field, and laboratory. The same evaluation guidelines required for equipment rinsate blanks will be applied to trip blanks. The results of the evaluation will be presented as part of the Representativeness assessment.

3.1.2.3 Field Duplicates

Field Duplicate samples for soil matrices are typically prepared by homogenizing a sample in the field, and then splitting the homogenized sample into two separate containers. The containers are then given unique field identifications (so that the duplicate is blind to the laboratory). Field duplicates will be collected at a frequency of 1 in 20 investigative samples, per matrix (not including soil gas). Field duplicates will be collected and analyzed to provide information regarding the natural variability of the sampled media as well as to evaluate analytical precision. The precision will be assessed quantitatively by calculating the relative percent difference (RPD) for each analyte, using the following equation:

$$RPD = \frac{S-D}{(S+D)/2} \; x \; 100\%$$

where

S = Reported concentration of analyte in the field sample (REAL)

D = Reported concentration of analyte in the field duplicate (DUP)

Advisory RPDs for field duplicates were given in the site-wide QAPjP as 30 percent for water samples and 40 percent for soil matrices (DOE 1991d). These limits are similar to those set for laboratory control samples, and cannot be strictly applied to environmental samples because of the natural matrix variance that may exist in a field sample. Therefore, for the purposes of this discussion, the RPD values of 30 and 40 percent are referred to as advisory limits. The RPD between field duplicate samples may be an indication of sample homogeneity, sample matrix (i.e., dilutions), sampling precision, and/or analytical precision. The results of this evaluation will be presented as part of the Precision assessment (see Section 1.2.7.5).

3.1.2.4 Matrix Spike/Matrix Spike Duplicates

MS/MSD are aliquots of an investigative sample that are spiked, at the laboratory, with a known quantity of target analyte. The spiked investigative samples are then prepared and analyzed the same as other samples. MS/MSD samples will be collected, prepared, and analyzed at a frequency of 1 in 20 samples, or 1 per 14 day period, whichever is more frequent, per matrix (not including soil gas). It is incumbent on the field sampling crew to collect enough sample for the laboratory to obtain additional aliquots for spiking; however, the laboratory is responsible for tracking the frequency of the MS/MSD samples. MS/MSD samples will be collected, prepared, and analyzed for organic analyses in all matrices except soil gas. The GRRASP does not require MS/MSD samples for radionuclides. Results from spiked field samples provide an estimate of recovery bias associated with the matrix. These data will be evaluated as part of the validation process.

3.1.2.5 Laboratory Replicates (of Investigative Samples)

LR of investigative samples apply to the analysis of radionuclides. An LR is an aliquot of an investigative sample that is prepared and analyzed the same as the investigative sample. The laboratory splits the sample. LR samples will be prepared, and analyzed at a frequency of 1 in 10 samples, per matrix. It is incumbent on the field sampling crew to collect enough sample for the laboratory to obtain additional aliquots for the LR; however, the laboratory is responsible for tracking the frequency of the LR samples. LR samples may provide information on sample homogeneity, radionuclide distribution in the matrix, sampling precision, and/or analytical precision. These data will be evaluated as part of the validation process.

3.1.2.6 Ambient Blank

An ambient blank is an air sample that is representative of the ambient conditions. It should be submitted blind to the laboratory. Ambient blanks will be collected for the soil gas confirmation samples only. These will be collected at a frequency of 1 in 20 investigative samples, or one per day, whichever is more frequent. The ambient blanks will be evaluated as part of the validation process.

3.2 PARCC PARAMETERS

The PARCC parameters (i.e., precision, accuracy, representativeness, completeness, and comparability) are indicators of data quality. These parameters and their specific applications for the OU-2 Trenches and Mound Site Characterization Work Plan are described in the following sections.

3.2.1 Precision

Precision is a quantitative measure of data quality that refers to the reproducibility or degree of agreement among replicate measurements of a single analyte. Analytical precision for a single analyte may be expressed as a percentage of the difference between results of duplicate samples for a given analyte (DOE 1991d). Precision control limits for SW-846 Methods 8240 and 8270 should be based on CLP-RAS methodology; however, the limits may vary slightly depending on the laboratory (Rocky Flats). Precision control limits for modified Method 8010 may need to be established and approved. Precision control limits for the analysis of radionuclides are referenced in the method or GRRASP (DOE 1991d). The laboratory contractor will be pre-approved by the operating contractor. These data will be evaluated during data validation by the validation contractor.

Precision will also be assessed by calculating the RPD for field duplicates. This evaluation will be performed as part of the EE/CA. The RPDs for field duplicates will be evaluated as described in Section 3.1.2.3, above.

3.2.2 Accuracy

Accuracy is a quantitative measure of data quality that refers to the degree of difference between measured or calculated values and the true value. Accuracy control limits may be applied to control samples prepared by the laboratory (e.g., blank spikes and/or laboratory control samples). Accuracy control limits for SW-846 Methods 8240 and 8270 should be based on CLP-RAS methodology; however, the limits may vary slightly depending on the laboratory (Rocky Flats). Accuracy control limits for modified Method 8010 may need to be established and approved. Accuracy control limits for the analysis of radionuclides are referenced in the method or GRRASP (DOE 1991d). The laboratory contractor will be pre-approved by the operating contractor. These data will be evaluated during data validation by the validation contractor.

Accuracy limits may also be applied to investigative samples that are spiked at the laboratory (e.g., MS/MSD samples and surrogate spikes); however, because of natural matrix variance in investigative samples, the limits are advisory only. These data will be evaluated during data validation by the validation contractor.

3.2.3 Representativeness

Representativeness is a qualitative measure of data quality defined by the degree to which the data accurately and precisely represent a characteristic of a population, parameter variations at a sampling point, a process condition, or an environmental condition (DOE 1991d). Representativeness is addressed by ensuring that the work plan justifies the sampling locations and that a sufficient number of samples are collected. Representativeness is optimized by careful development and review of the SOPs used for sample collection and sample analysis.

The discussion of representativeness in the PARCC assessment will be limited to an evaluation of whether analytical results for field samples are truly representative of environmental concentrations, or whether they may have been influenced by the introduction of contamination during collection and handling. Possible contamination in the laboratory is addressed during data validation. Other aspects of representativeness, such as numbers of samples and the spatial distribution of samples, will be not be discussed in the QA/QC section. Possible introduction of contamination will be evaluated by examination of the analytical results for equipment rinsates and trip blanks, as described in Sections 3.1.2.1 and 3.1.2.2, above.

3.2.4 Completeness

Completeness is a quantitative measure of data quality expressed as the percentage of valid or acceptable data obtained from a measurement system. The objectives of the field sampling program are to obtain samples for all analyses required at each individual site, to provide sufficient sample material to complete those analyses, and to produce QC samples that represent all possible contamination situations (i.e., potential contamination during collection, transportation, or storage) (DOE 1991d). This evaluation will be performed as part of the EE/CA.

3.2.5 Comparability

Comparability is a qualitative measure defined by the confidence with which one data set can be compared to another. Differences in field and laboratory procedures greatly affect comparability. Comparability is optimized by implementation of the SAP, standardized analytical protocols, SOPs for field investigations, and by reporting data in uniform units.

3.3 SAMPLE MANAGEMENT

Good sample management is a critical component of the Trenches and Mound Site Characterization Work Plan. It facilitates maintaining sample integrity from sampling through analysis. Sample management, including labeling, sampling, decontamination, preservation/storage, chain of custody, and shipping will be conducted in accordance with applicable SOPs.

3.4 DATA REPORTING

Field data will be collected and reported as outlined in SOP FO.14, Field Data Management. Field data will be reported to the on-site manager and the operating contractor personnel or their designees, in order to facilitate decision making for the observational sampling approach. The EPA-CLP sample results will be reported as specified in the GRRASP and the "Procedures for Providing the Electronics Deliverable Lab Data to the Rocky Flats Environmental Data Tracking System."

3.5 STANDARD OPERATING PROCEDURES

In general, all field work will be conducted in accordance with existing Rocky Flats SOPs. In some cases, however, modifications to the SOPs may be necessary to perform the field activities specified herein. Where procedures differ from those stated in the SOPs, they will be thoroughly documented in a document modification request (DMR). A list of existing SOPs applicable to the OU-2 Trenches and Mound Site Characterization Work Plan field investigations is presented in Table 3.5-1.

TABLE 3.1-1

FIELD QA/QC
SAMPLE COLLECTION FREQUENCY

Activity	Frequency
Field Duplicate	1 in 20*
Trip Blank	1 per cooler containing VOC sampling containers and/or samples**
Equipment Rinsate Blank	1 in 20 or once per day, whichever is more frequent***
Ambient Blank (soil gas only)	1 in 20 or once per day, whichever is more frequent
Laboratory Replicate	1 in 10 samples, per matrix
Matrix Spike/Matrix Spike Duplicates	1 in 20 samples or 1 per 14 day period, whichever is more frequent ****

* 1 QA/QC duplicate sample collected per every 20 investigate samples collected.

** Analyze only if VOCs are detected in associated investigative samples or if breakage occurs. Does not apply to soil gas.

*** 1 QA/QC equipment blank sample collected per every 20 investigative samples collected, or 1 equipment blank collected per day, whichever is more frequent.

**** Applies to organics only.

TABLE 3.5-1
APPLICABLE STANDARD OPERATING PROCEDURES

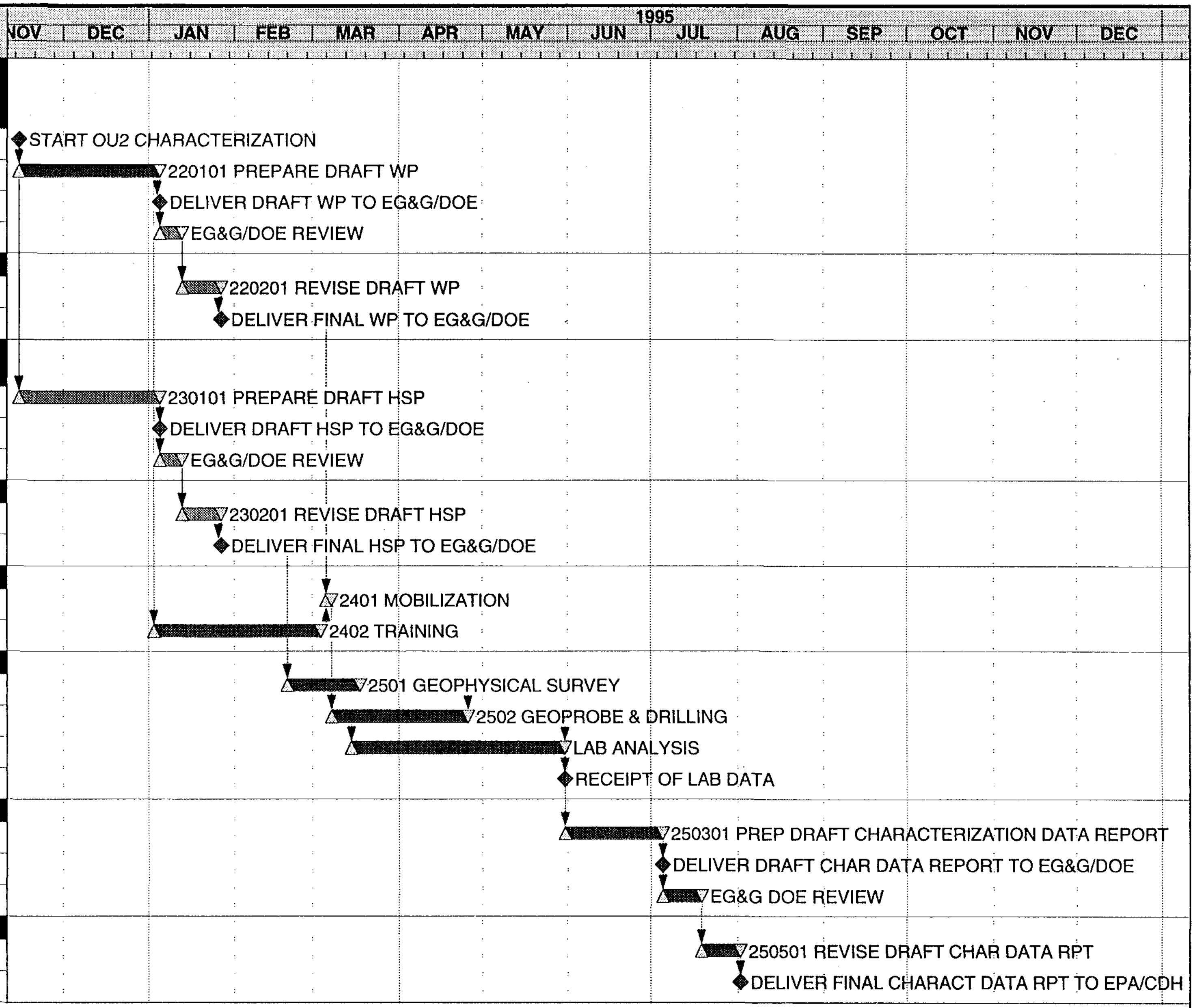
SOP NUMBER	TITLE
FO.01	Air Monitoring and Dust Control*
FO.03	General Equipment Decontamination
FO.04	Heavy Equipment Decontamination
FO.08	Handling of Drilling Fluids and Cuttings*
FO.10	Receiving, Labeling, and Handling Environmental Material Containers*
FO.13	Containerization, Preserving, Handling, and Shipping of Soil and Water Samples*
FO.14	Field Data Management
FO.15	Photoionization Detectors (PIDs) and Flame Ionization Detectors (FIDs)*
FO.16	Field Radiological Measurement
GT.02	Drilling and Sampling Using Hollow-Stem Auger Techniques*
GT.05	Plugging and Abandonment of Boreholes*
GT.09	Soil Gas Sampling and Field Analyses*
GT.10	Borehole Clearing
GT.17	Land Surveying
GT.18	Surface Geophysical Surveys*
GT.19	Field Gas Chromatographs*

* May require modification for OU-2 Trenches and Mound Site Characterization Work Plan field activities. Modifications, if necessary, will be documented with a DMR.

4.0 SCHEDULE

The draft schedule for implementation of the OU-2 Trenches and Mound Site Characterization Work Plan (Figure 4.1-1) is designed to allow data to be used in the preparation of EE/CAs for early removal actions and in support of the Corrective Measures Study/Feasibility Study (CMS/FS) for OU-2. It is anticipated that the field program will require approximately three to four months to complete. This estimated duration assumes that three geoprobe crews will be used simultaneously. To expedite the schedule, nonvalidated data will be included in the characterization data report.

Activity Description	Orig Dur	Early Start	Early Finish
22 WORK PLAN			
22.01 DRAFT WP			
START OU2	0	15NOV94*	
220101 PREPARE DRAFT	37	15NOV94	04JAN95
DELIVER DRAFT WP TO	0		04JAN95
EG&G/DOE REVIEW	6	05JAN95	12JAN95
22.02 FINAL WP			
220201 REVISE DRAFT WP	10	13JAN95	26JAN95
DELIVER FINAL WP TO	0		26JAN95
23 HEALTH & SAFETY PLAN			
23.01 DRAFT HSP			
230101 PREPARE DRAFT	37	15NOV94	04JAN95
DELIVER DRAFT HSP TO	0		04JAN95
EG&G/DOE REVIEW	6	05JAN95	12JAN95
23.02 FINAL HSP			
230201 REVISE DRAFT	10	13JAN95	26JAN95
DELIVER FINAL HSP TO	0		26JAN95
24 MOBILIZATION AND TRAINING			
2401 MOBILIZATION	2	06MAR95	07MAR95
2402 TRAINING	44	03JAN95	03MAR95
25 CHARACTERIZATION			
2501 GEOPHYSICAL	20	20FEB95*	17MAR95
2502 GEOPROBE &	35	08MAR95	25APR95
LAB ANALYSIS	55	15MAR95	30MAY95
RECEIPT OF LAB DATA	0		30MAY95
25.03 DRAFT CHARACTERIZATION DATA REPORT			
250301 PREP DRAFT	25	31MAY95	04JUL95
DELIVER DRAFT CHAR	0		04JUL95
EG&G DOE REVIEW	10	05JUL95	18JUL95
25.05 FINAL CHARACTERIZATION DATA REPORT			
250501 REVISE DRAFT	10	19JUL95	01AUG95
DELIVER FINAL CHARACT	0		01AUG95



Project Start	19SEP94
Project Finish	01AUG95
Data Date	19SEP94
Plot Date	14FEB95

(c) Primavera Systems, Inc.

Early Bar
Progress Bar
Critical Activity

0020

Sheet 1 of 1

OU-2 TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN
FIELD PROGRAM SCHEDULE

Figure 4.1-1

5.0 REFERENCES

U.S. Department of Energy (DOE). 1994a. Second Preliminary Draft Technical Memorandum No. 4, OU-2 Subsurface IM/IRA, Soil Vapor Extraction Pilot Test, Site No. 1, Rocky Flats Environmental Technology Site, Golden, Colorado. October.

DOE. 1994b. Technical Memorandum No. 5, Human Health Risk Assessment Exposure Scenarios, 903 Pad, Mound and East Trenches Area Operable Unit No. 2, Rocky Flats Environmental Technology Site, Golden, Colorado. December.

DOE. 1993. Preliminary Draft Phase II RFI/RI Report, 903 Pad, Mound and East Trenches Area, Operable Unit No. 2, Rocky Flats Plant, Golden, Colorado. December.

DOE. 1992a. Rocky Flats Plant Site-wide Quality Assurance Project Plan for CERCLA Remedial Investigation/Feasibility Studies Activities, ER Program, Rocky Flats Plant, Golden, Colorado. June.

DOE. 1992b. Final Historical Release Report for the Rocky Flats Plant, Rocky Flats Plant, Golden, Colorado. June.

DOE. 1991a. Quality Assurance Addendum for Operable Unit No. 2 (Bedrock), 903 Pad, Mound, and East Trenches Areas Phase II RFI/RI. July.

DOE. 1991b. Final Phase II RFI/RI Work Plan (Alluvial) TM No. 1, RFP 903 Pad, Mound, and East Trenches Areas, Operable Unit No. 2, Rocky Flats Plant, Golden, Colorado. Environmental Restoration Program. August.

DOE. 1990a. Data Validation Functional Guidelines, Environmental Restoration Department, Environmental Monitoring and Assessment Division. EG&G, Rocky Flats Plant, Golden, Colorado. March.

DOE. 1990b. General Radiochemistry and Routine Analytical Services Protocol (GRRASP). ER Program, Rocky Flats Plant, Golden, Colorado. August.

U.S. Environmental Protection Agency (EPA). 1993. Data Quality Objectives Process for Superfund, Interim Final Guidance. EPA 54-R-93-071. September.

RF/ER-95-0010

EG&G

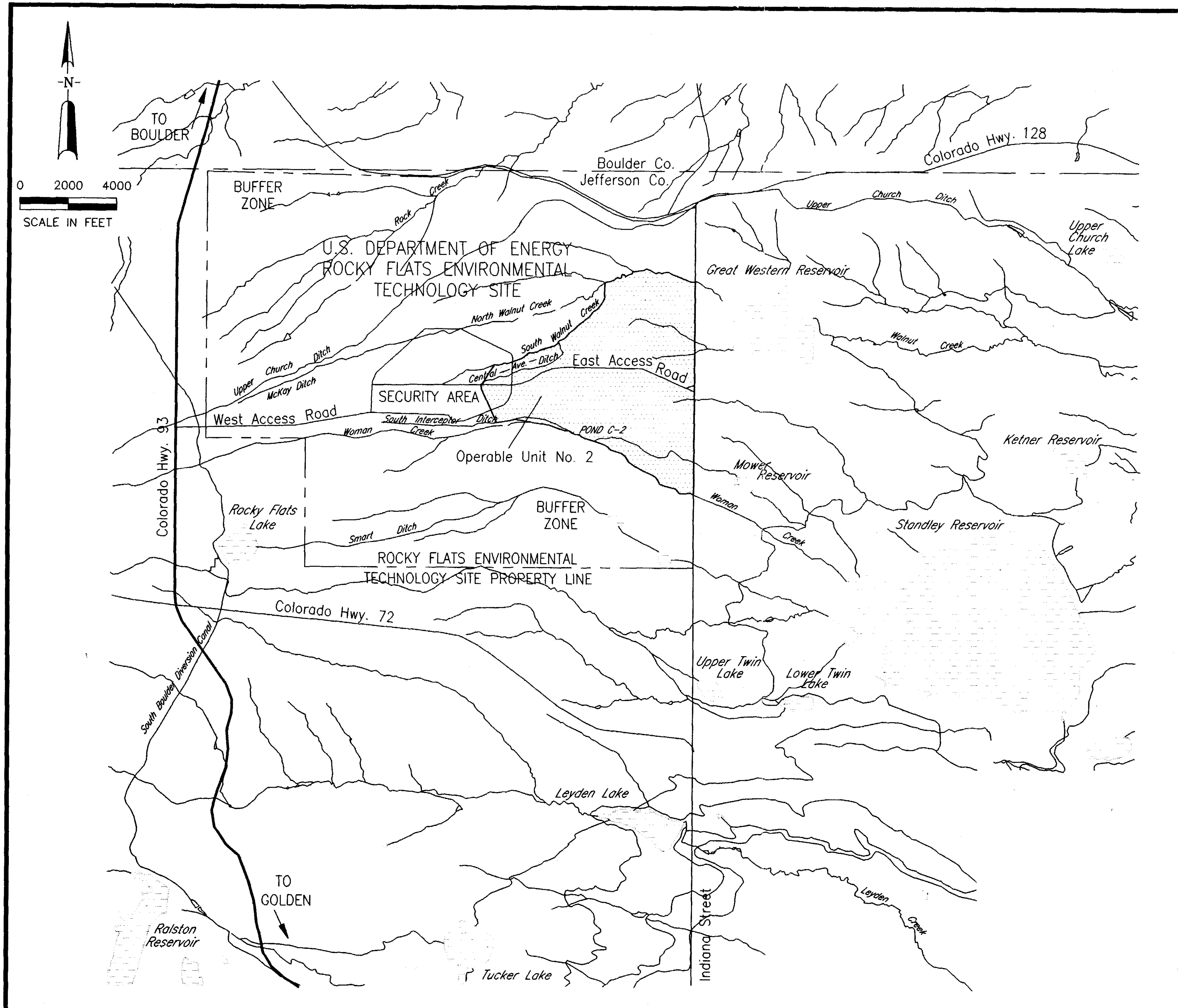
ROCKY FLATS

Final Trenches and Mound Site Characterization Work Plan

Operable Unit No. 2

Rocky Flats Environmental Restoration Project

February 1995



EXPLANATION

OPERABLE UNIT NO.2

SURFACE WATER BODY

(after: U.S.G.S. Quads.;
Louisville, 1979; Golden, 1980;
Lafayette, 1979 and Arvada, 1980.)

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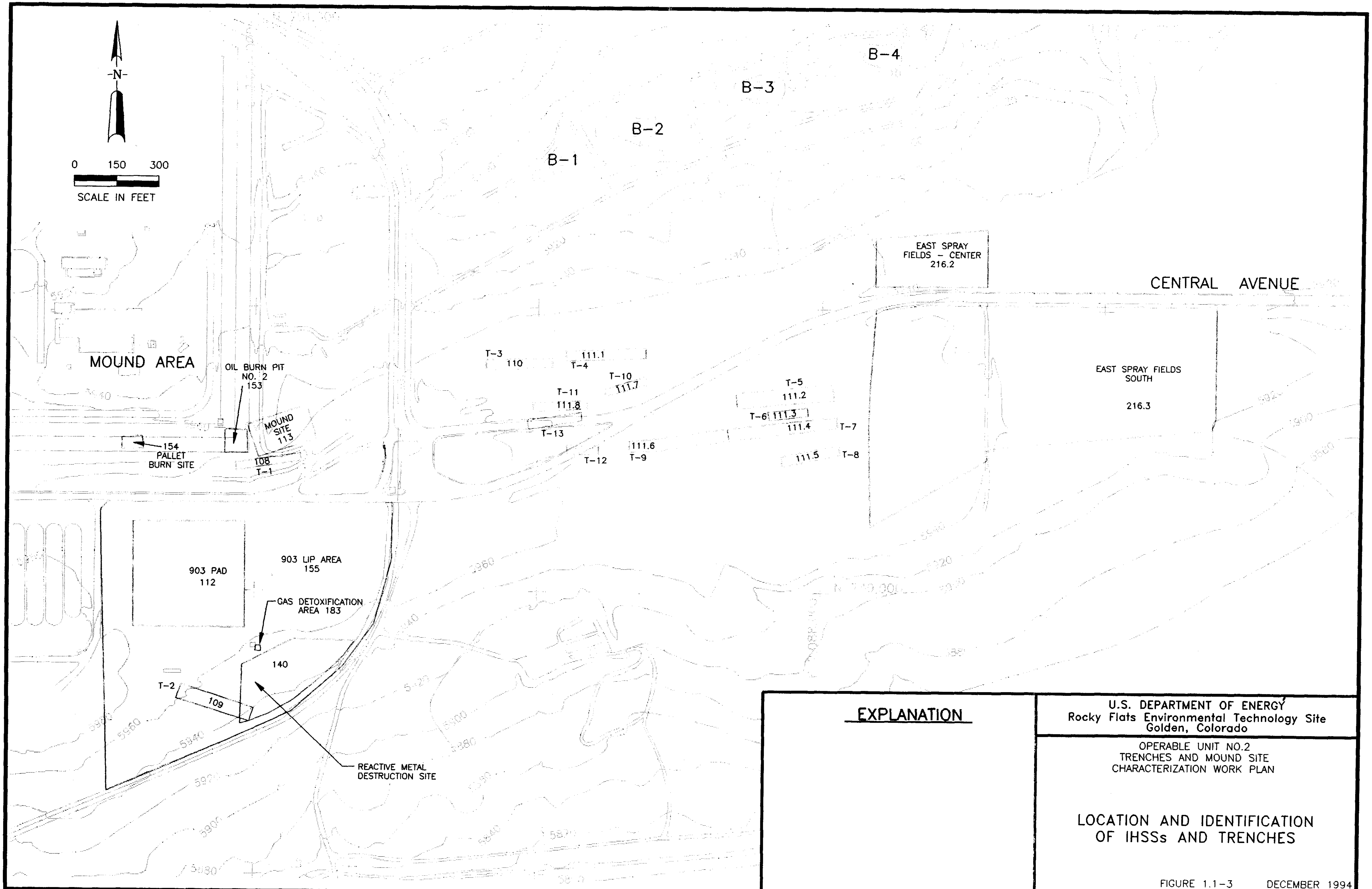
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

ROCKY FLATS ENVIRONMENTAL
TECHNOLOGY SITE
OPERABLE UNIT NO.2

FIGURE 1.1-2 DECEMBER 1994



EXPLANATION

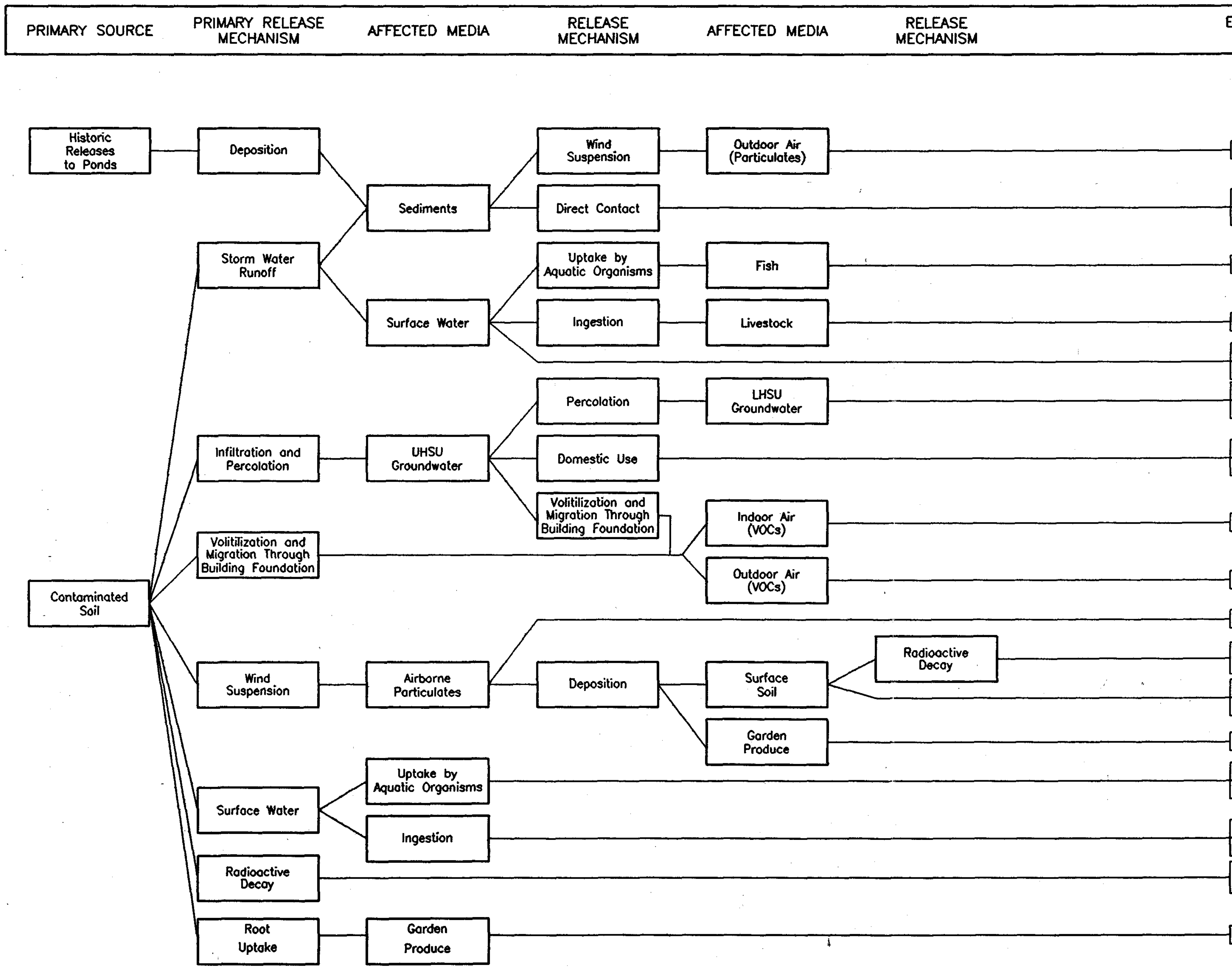
U.S. DEPARTMENT OF ENERGY
Rocky Flats Environmental Technology Site
Golden, Colorado

OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

LOCATION AND IDENTIFICATION OF IHSSs AND TRENCHES

FIGURE 1.1-3 DECEMBER 1994

OU2RI798 1=300



Exposure Route	Current Off-site Resident	Current On-site Worker	Future On-site Office Worker	Future On-site Construction Worker	Future On-site Ecological Researcher	Future On-site Gravel Miner	Future On-site Resident	Future Off-site Resident
Inhalation	N	N	N	N	I	N	I	N
Oral	N	N	N	N	S	N	S	S
Dermal	N	N	N	N	I	N	I	I
Oral	N	N	N	N	N	N	N	N
Oral	N	N	N	N	N	N	N	N
Oral	N	N	N	N	S	N	S	S
Dermal	N	N	N	N	I	N	I	I
Oral	N	N	N	N	N	N	N	N
Inhalation	N	N	N	N	N	N	N	N
Oral	N	N	N	N	N	N	S	N
Inhalation	N	N	N	N	N	N	S	N
Inhalation	N	N	S	N	N	N	S	N
Inhalation	N	N	N	N	N	N	N	N
Inhalation	I	I	I	I	I	I	I	I
External Radiation	N	N	N	N	N	N	N	N
Oral	I	N	N	N	N	N	N	I
Dermal	I	N	N	N	N	N	N	I
Oral	I	N	N	N	N	N	I	I
Oral	N	S	S	N	S	N	S	N
Dermal	N	I	I	N	I	N	I	N
Oral	N	N	N	S	N	S	N	N
Dermal	N	N	N	I	N	I	N	N
External Radiation	N	I	I	I	I	I	I	N
Oral	N	N	N	N	N	N	I	N

L E G E N D

S Significant Potential Exposure Pathway
I Insignificant Potential Exposure Pathway
N Negligible or Incomplete Exposure Pathway
UHSU Upper Hydrostratigraphic Unit

Note: Significant and insignificant potential exposure pathways will be quantitatively evaluated.

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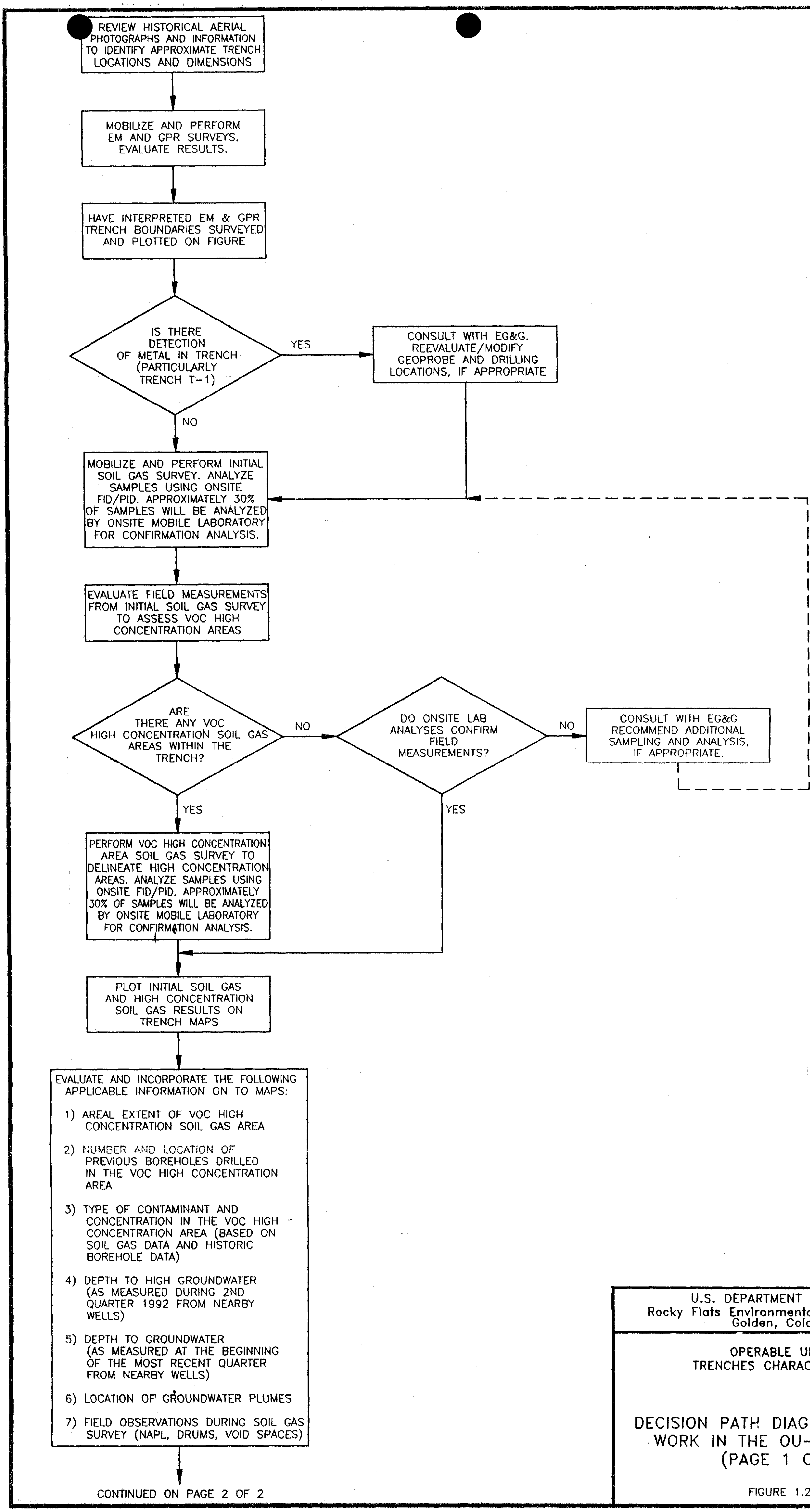
OPERABLE UNIT NO. 6
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

CONCEPTUAL SITE MODEL
FOR HUMAN EXPOSURE PATHWAYS

FIGURE 1.2-1 FEBRUARY 1995



CONTINUED ON PAGE 2 OF 2

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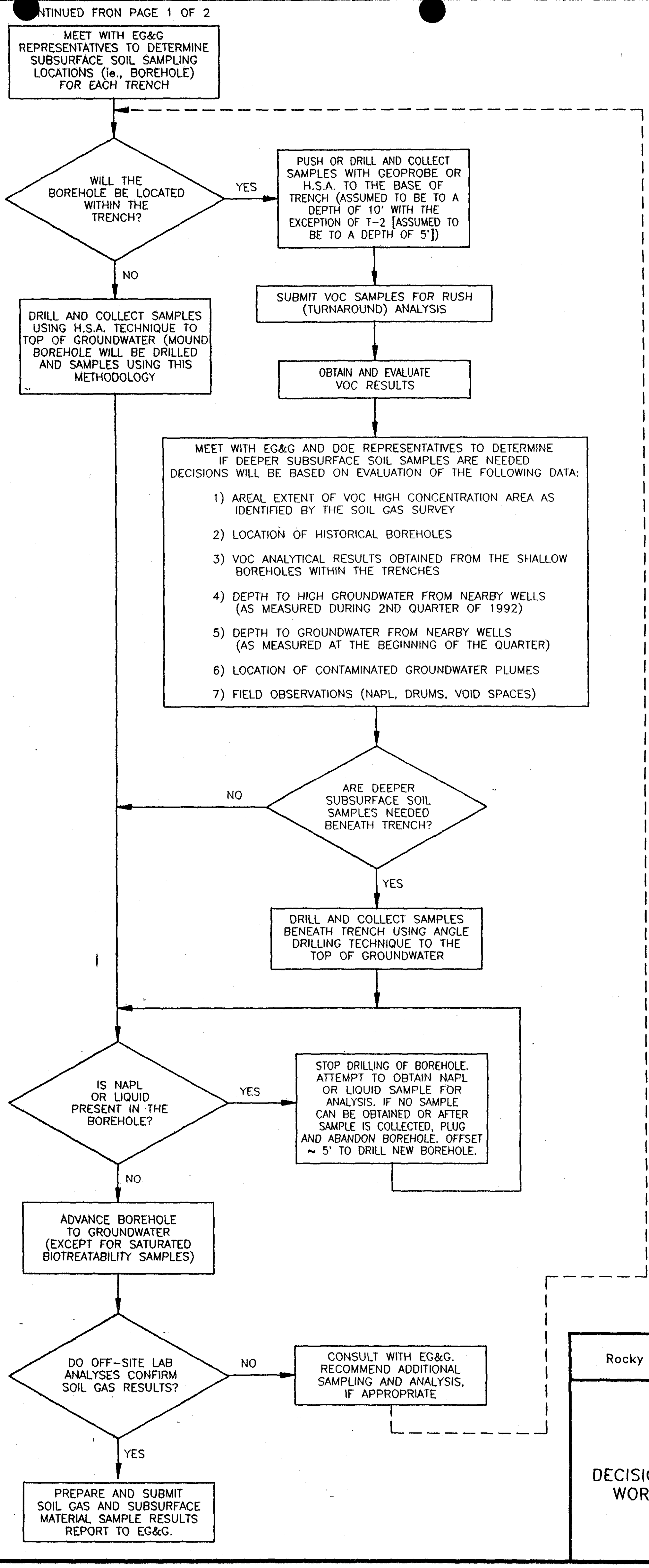
OPERABLE UNIT 2
TRENCHES CHARACTERIZATION

DECISION PATH DIAGRAM FOR FIELD WORK IN THE OU-2 TRENCHES (PAGE 1 OF 2)

FIGURE 1.2-6 MARCH 1995

75-DMR-[illegible]



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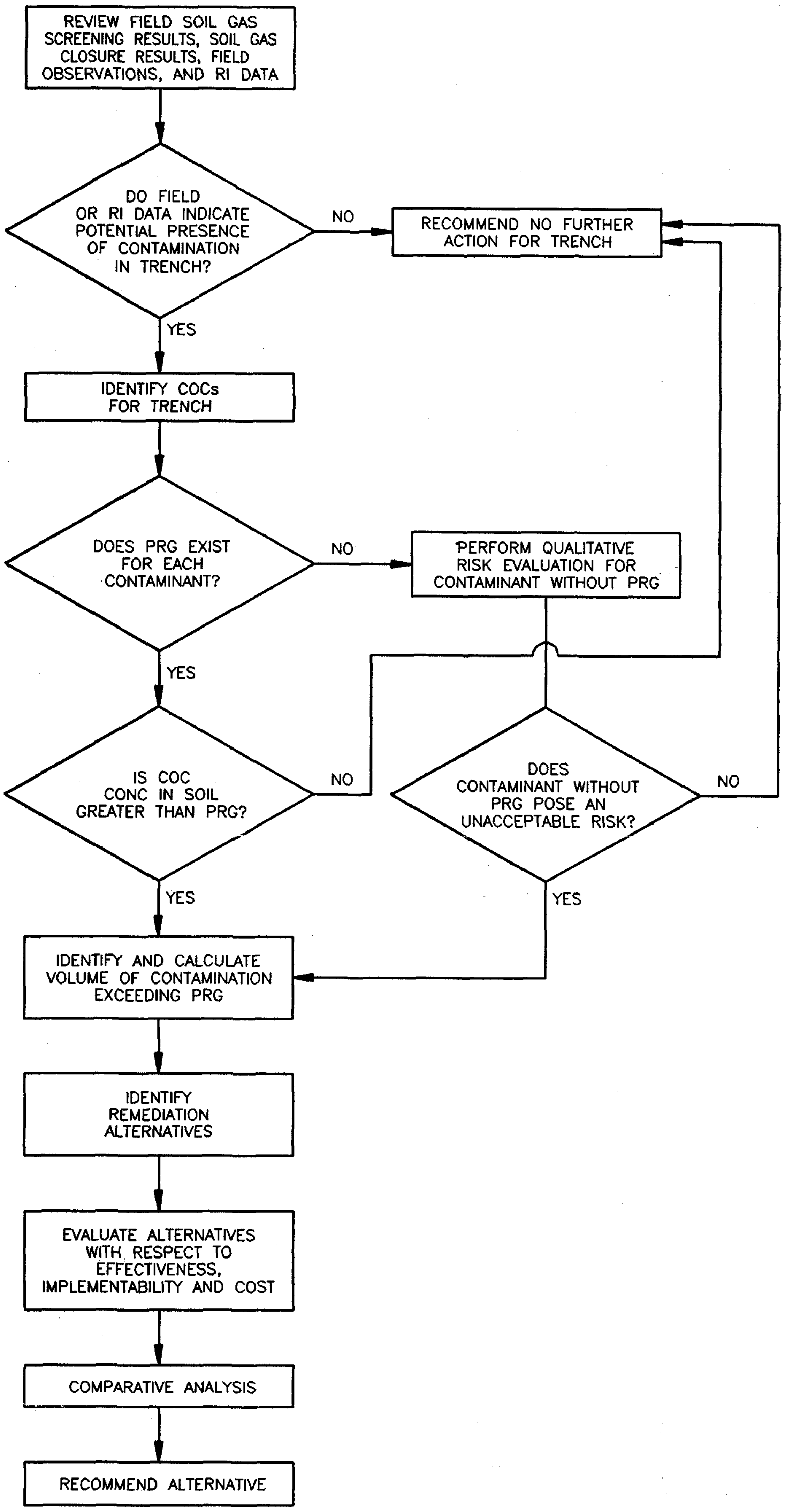
OPERABLE UNIT 2
TRENCHES CHARACTERIZATION

DECISION PATH DIAGRAM FOR FIELD WORK IN THE OU-2 TRENCHES (PAGE 2 OF 2)

FIGURE 1.2-6 MARCH 1995

OU2RI845 1=1



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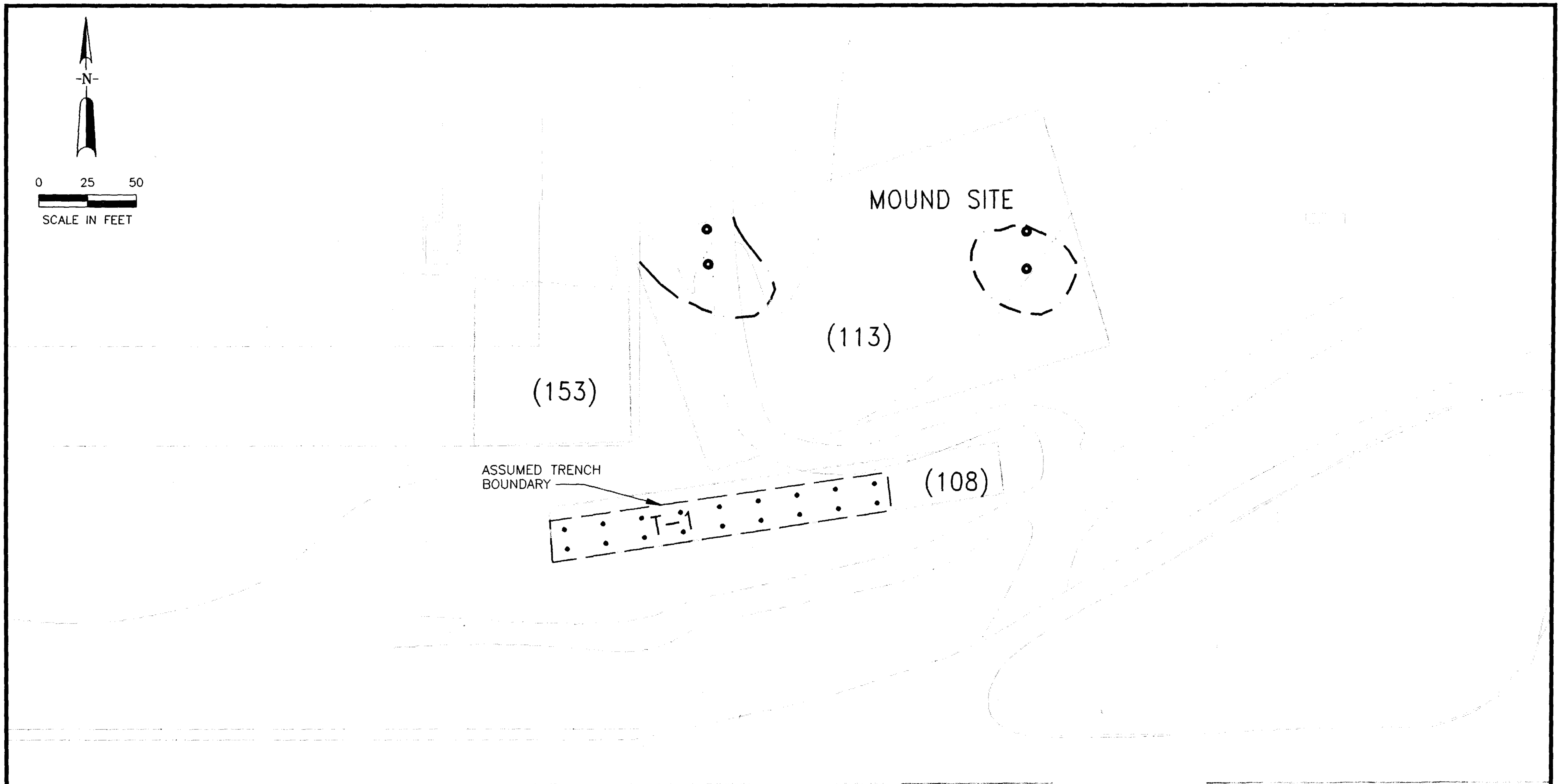
OPERABLE UNIT 2
TRENCHES CHARACTERIZATION

DECISION PATH DIAGRAM FOR EE/CA FOR OU-2 TRENCHES

FIGURE 1.2-7 FEBRUARY 1995



EXPLANATION

T-1 ASSUMED TRENCH BOUNDARY

(113) INDIVIDUAL HAZARDOUS SUBSTANCE SITE DEFINED BOUNDARY

• PROPOSED SOIL GAS SAMPLING LOCATION (20' GRID SPACING CENTERED ALONG LONG AXIS OF THE TRENCH)

⊙ PROPOSED HOLLOW-STEM AUGER BOREHOLE LOCATION

— — 1000 UG/L ISOPLETH FOR TOTAL VOCs SOURCE: DOE 1994a

NOTE:
SOIL GAS LOCATIONS MAY CHANGE AFTER GEOPHYSICAL SURVEYS ARE COMPLETED.

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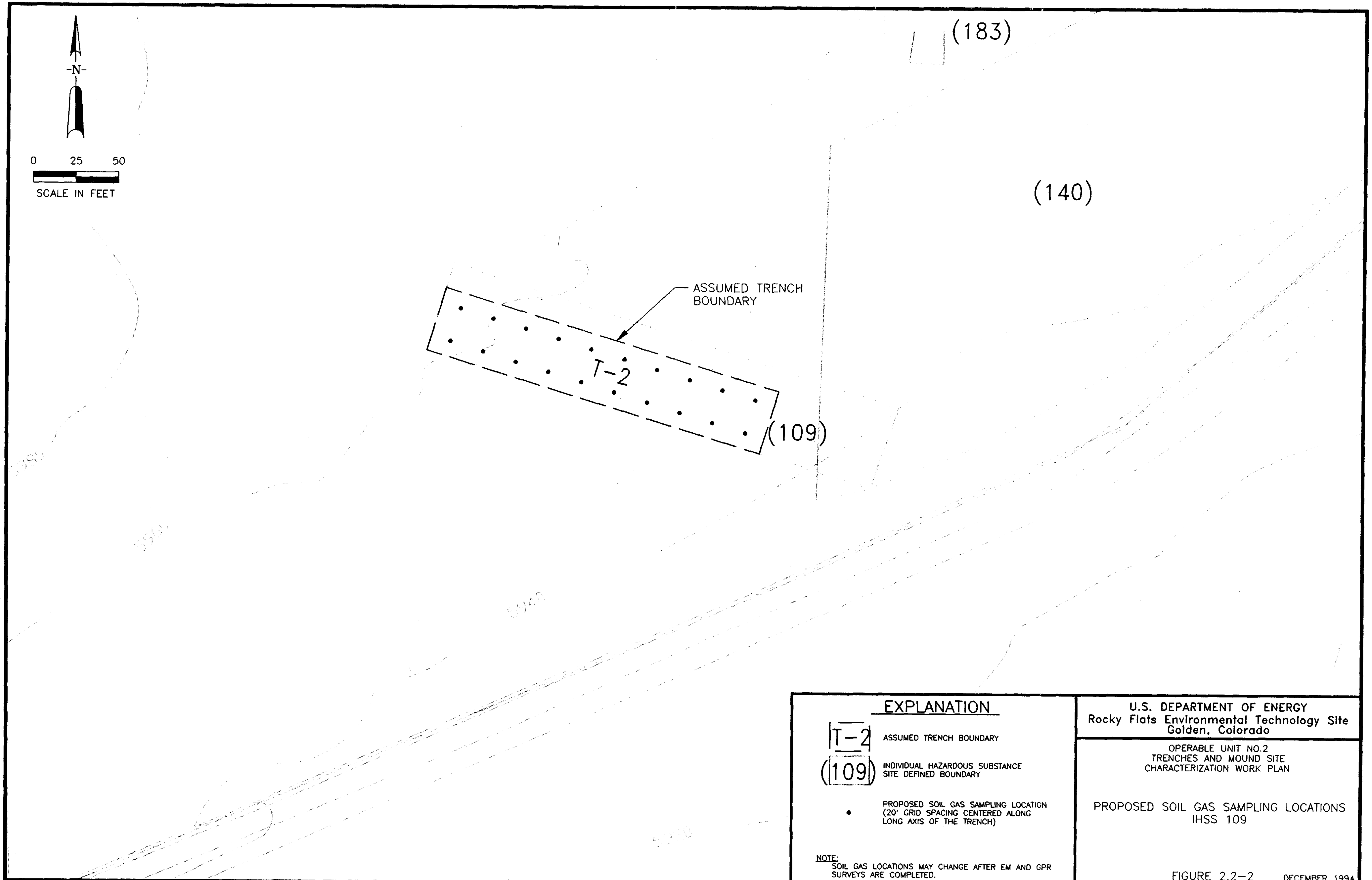
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

PROPOSED SOIL GAS SAMPLING AND HOLLOW-STEM AUGER BOREHOLE LOCATIONS, IHSSs 108 AND 113

FIGURE 2.2-1 DECEMBER 1994

 OU2RI799 1=50



EXPLANATION

T-2	ASSUMED TRENCH BOUNDARY
(109)	INDIVIDUAL HAZARDOUS SUBSTANCE SITE DEFINED BOUNDARY
•	PROPOSED SOIL GAS SAMPLING LOCATION (20' GRID SPACING CENTERED ALONG LONG AXIS OF THE TRENCH)

NOTE:
SOIL GAS LOCATIONS MAY CHANGE AFTER EM AND GPR SURVEYS ARE COMPLETED.

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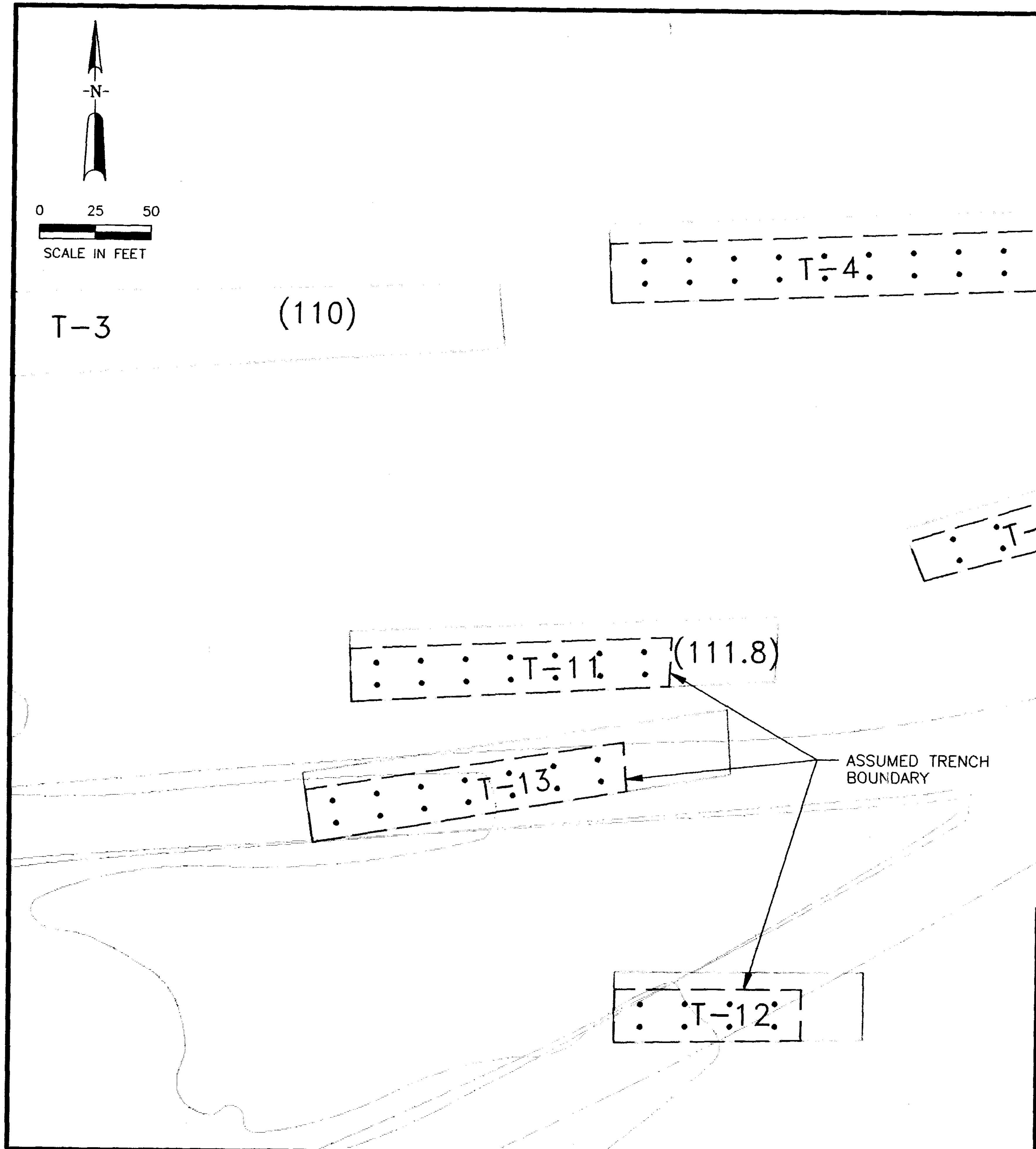
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

PROPOSED SOIL GAS SAMPLING LOCATIONS
IHSS 109

FIGURE 2.2-2 DECEMBER 1994

 OU2RI800 1=50



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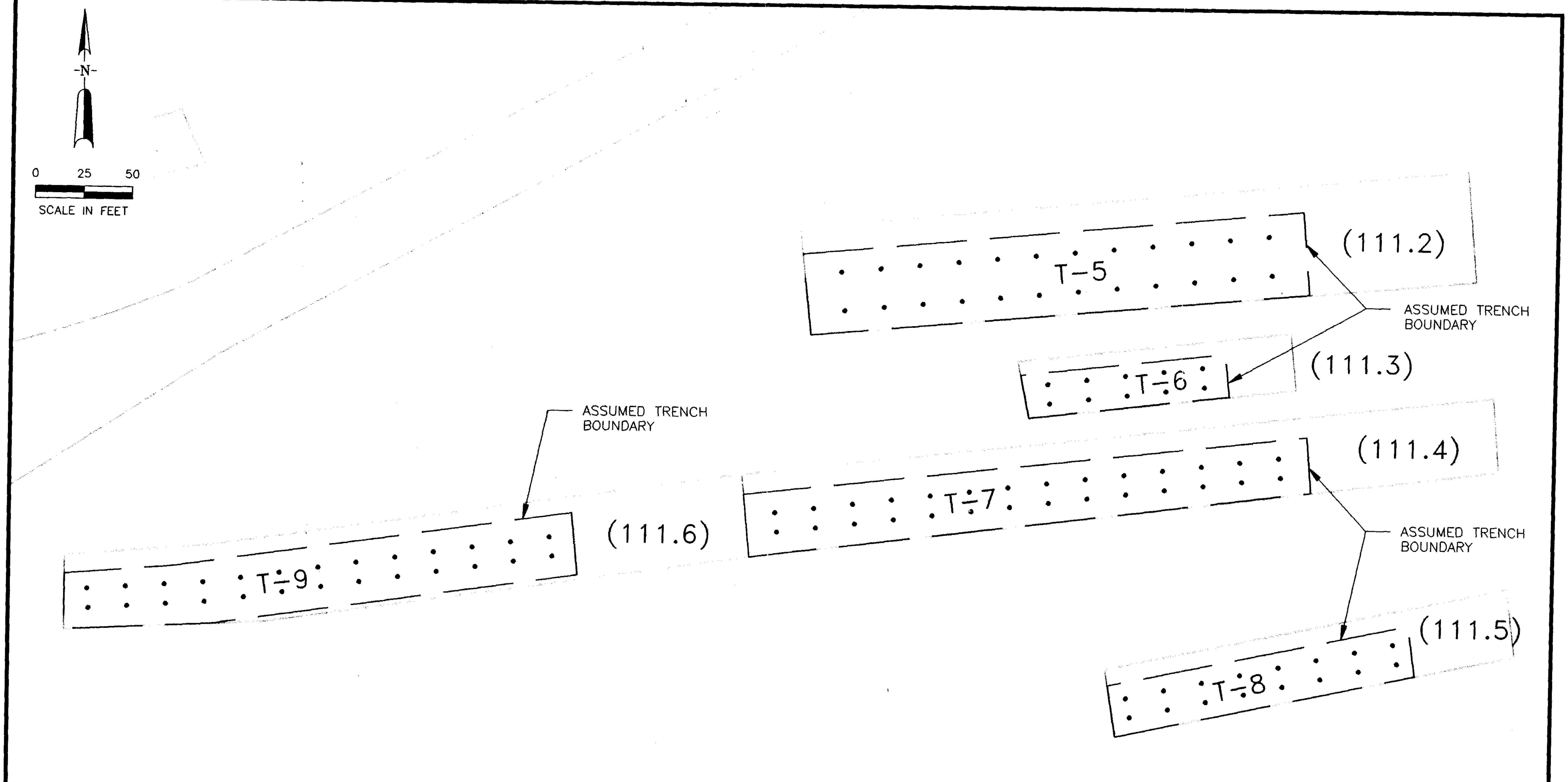
OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

PROPOSED SOIL GAS SAMPLING LOCATIONS
IHSSs 111.1, 111.7, 111.8,
AND TRENCHES T-12, T-13

FIGURE 2.2-3 DECEMBER 1994

 OU2RI801 1=50



EXPLANATION

- T-1 — ASSUMED TRENCH BOUNDARY
- (113) — INDIVIDUAL HAZARDOUS SUBSTANCE SITE DEFINED BOUNDARY
- • — PROPOSED SOIL GAS SAMPLING LOCATION (20' GRID SPACING CENTERED ALONG LONG AXIS OF THE TRENCH)

NOTE:
SOIL GAS LOCATIONS MAY CHANGE AFTER EM AND GPR SURVEYS ARE COMPLETED.

U.S. DEPARTMENT OF ENERGY
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OPERABLE UNIT NO.2
TRENCHES AND MOUND SITE
CHARACTERIZATION WORK PLAN

PROPOSED SOIL GAS SAMPLING LOCATIONS
IHSSs 111.2, 111.3, 111.4, 111.5, AND 111.6

FIGURE 2.2-4 DECEMBER 1994

OU2RI802 1=50